SIEMENS

KION
Service Manual

E382 E392E 061 01 01 02

Important

General

- Documentation for the KION™ Anesthesia System consists of:
  - Operating Manual
  - Service Manual
  - Spare Parts List
  - Documentation for the KION Display.
- Documentation for all optional equipment included in the KION System is also available.
- The Operating Manual is an indispensable complement to the Service Manual for proper servicing.
- A version label can be found by the mains power inlet. This label is an "Operating Manual version label" indicating the version number of the Operating Manual to be used with this KION System.
- This information in this Service Manual is based on the "KION System Level 3.0", that is:
  - Units delivered from factory starting in January 1999.
  - Older units updated with the mandatory "Update 1998-12".

Text inside a box is used to highlight important information.

- In addition to the Important information given here and in the related documents (e. g. in the Operating Manual), always pay attention to applicable local and national regulations.
- Responsibility for the safe functioning of the equipment reverts to the owner or user in all cases in which service or repair has been done by a non-professional or by persons who are not employed by or authorized by Siemens, and when the equipment is used for other than its intended purpose.
- Data on internal pressures in the KION are given in Pa (bar).
  Airway pressures are given in cm H_2O (Pa).

1 hPa = 1 mbar	1 mbar = 1 hPa
1 kPa = 10 mbar	1 mbar = 0.1 kPa
1 kPa = 0.01 bar	1 bar = 100 kPa
1 kPa ≈ 10 cm H_2O	1 cm H_2O ≈ 0.1 kPa
1 kPa ≈ 0.01 at	1 at ≈ 100 kPa
1 kPa ≈ 0.01 kgf/cm^2	1 kgf/cm^2 ≈ 100 kPa
1 kPa ≈ 0.01 kp/cm^2	1 kp/cm^2 ≈ 100 kPa
1 kPa ≈ 0.145 psi	1 psi ≈ 6.9 kPa

Installation

- Only personnel authorized by Siemens shall be permitted to install the KION System. The installation and handing over procedures are described in the "KION – Installation Instructions".

Functional check and Calibration

- After any maintenance or service intervention in KION, perform a "Function check" and a "Calibration" according to instructions in the KION – Operating Manual.

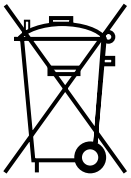
Hazard notices

- Before disassembling or assembling the KION System, make sure that the:
  - Gas supply is disconnected.
  - Mains power cable is disconnected.
  - Power switch is set to Off. If the power switch is set in any other position, the internal battery will supply power to the PC boards.
  - The back-up batteries are disconnected when the power section is open.
  - All gas conveying parts are cleaned according to instructions in the KION - Operating Manual, chapter Routine cleaning.

Important

Service

- The KION Anesthesia System must be serviced at regular intervals by personnel authorized by Siemens. Any maintenance must be noted in a log book provided in accordance with national regulations. We recommend that service is done as a part of a service contract with Siemens.
- Maintenance must be performed every:
  - Six months. This corresponds to approx. 1.000 hours of operation calculated as operating time of 40 hours a week during six months. Details are found in the Operating Manual.
  - Twelve months or every 3000 hours of operation whichever comes first. Details are found in this Service Manual, chapter "Maintenance".
  - Three years. The internal battery shall be replaced every three years according to instructions in this Service Manual, chapter "Maintenance".
- Worn-out batteries must be returned to the place of purchase or to a place where they can be safely disposed of. Batteries must not be disposed of with ordinary waste. All other disposable parts shall be discarded according to hospital rules and in an environmentally safe way.



- When working with ESD sensitive components, always use a grounded wrist band and a grounded work surface. Adequate service tools must always be used.

To the responsible service personnel

- The contents of this document are not binding. If any significant difference is found between the product and this document, please contact Siemens for further information.
- We reserve the right to modify products without amending this document or advising the user.
- Only personnel authorized by Siemens shall be permitted to service or repair the KION System. Only Siemens-Elema genuine spare parts must be used. PC boards (spare parts) must always be kept in a package for sensitive electronic devices. Siemens will not otherwise assume responsibility for the materials used, the work performed or any possible consequences of same.

CE 0413

- The device complies with the requirements of the Medical Device Directive 93/42/EEC.

Notes

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1

Main units

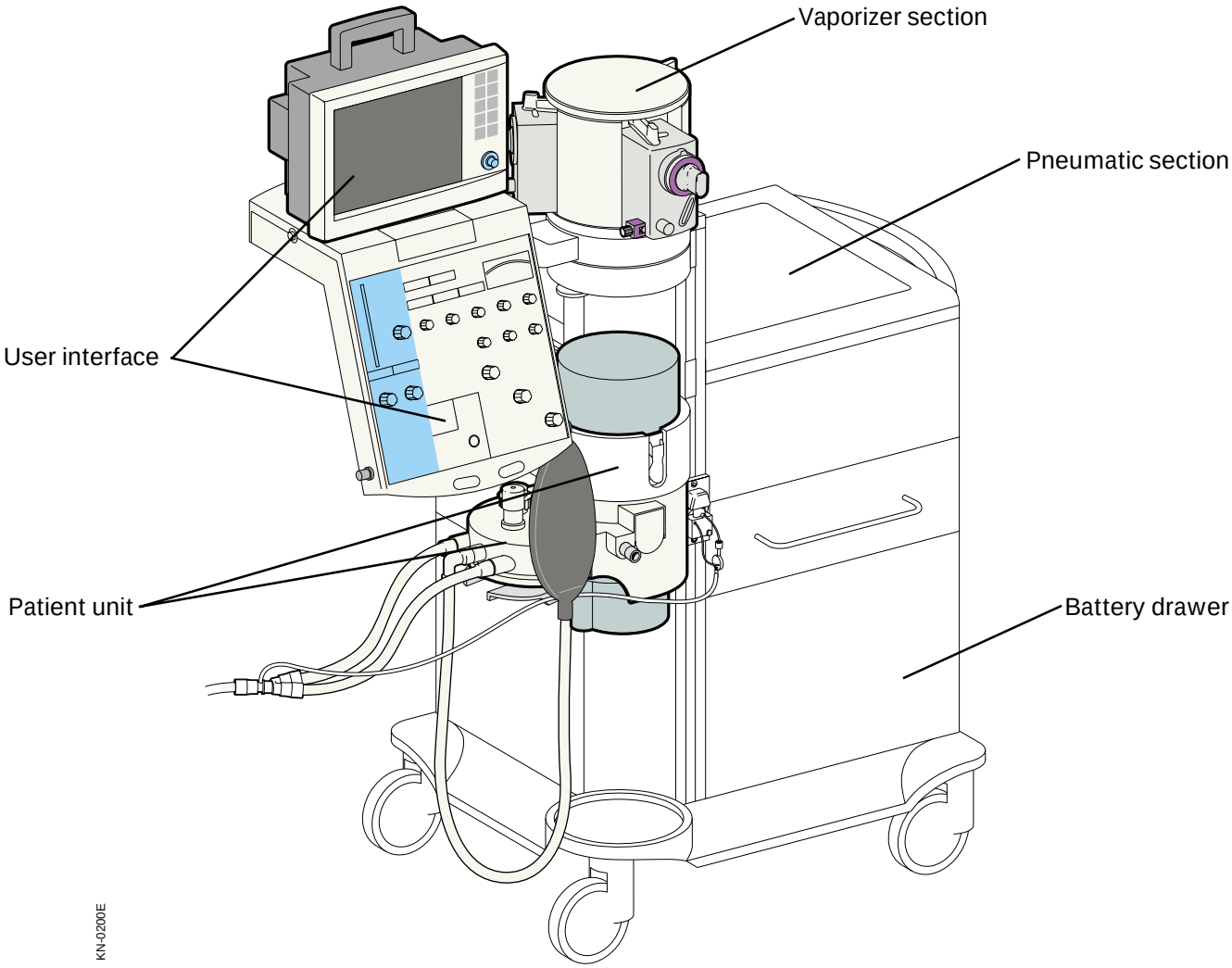
The KION System can be divided into the following functional main units:

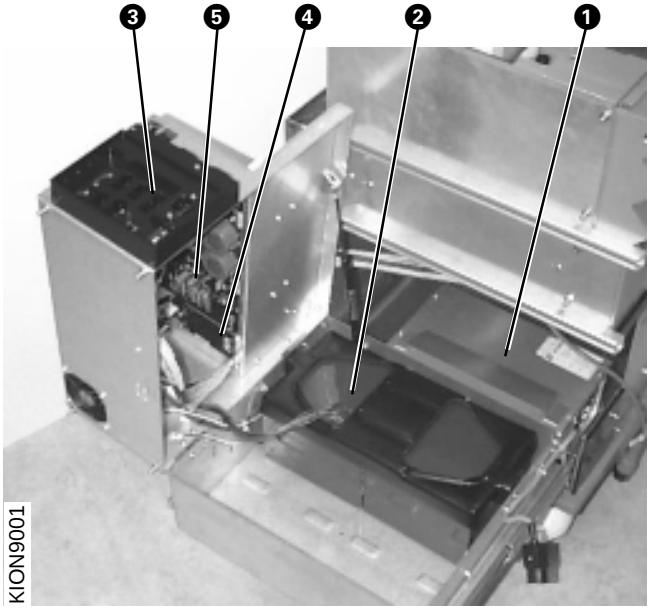
- Battery drawer
- Pneumatic section
- Vaporizer section
- User interface, i. e. the Control panel and the KION Display (a Siemens patient monitor intended for use with the KION System, e. g. SC 7000, SC 9000 or SC 9000XL).
- Patient unit.

All these main units are incorporated in or attached to the trolley which is the main body of the system.

The following optional equipment can also be incorporated in the KION System:

- Overflow screen
- Multi-gas module
- Isolation transformer
- Backup gas supply manifold
- Suction equipment
- Auxiliary O_2 supply
- Gas evacuation
- Accessory and Monitor shelfs.





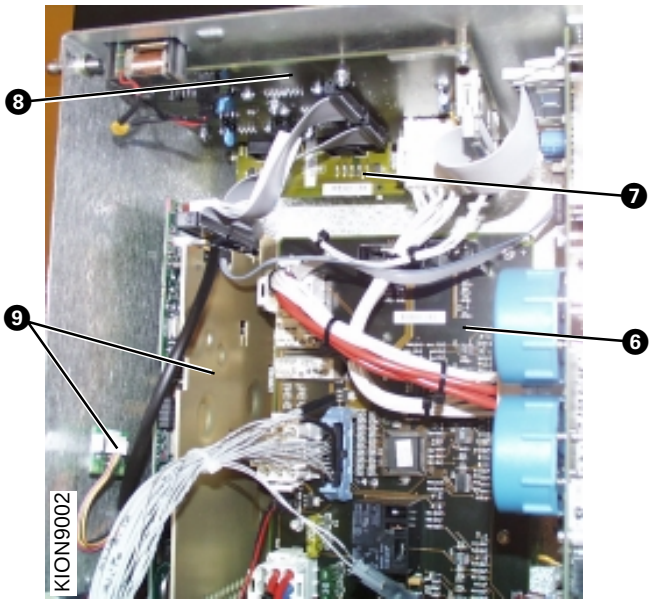
Battery drawer

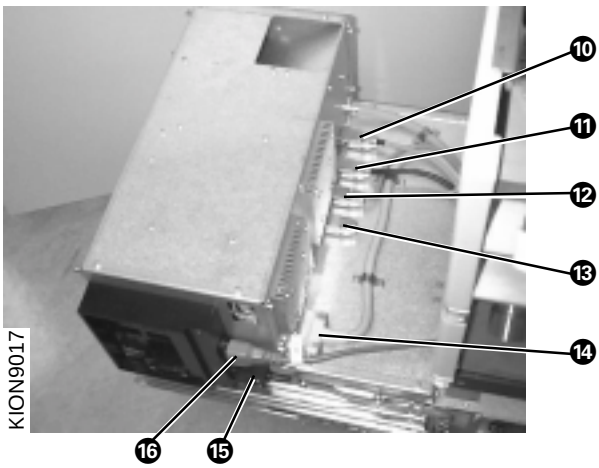
The battery drawer can be pulled out from the trolley and thus easier to access. It contains functions for power supply and communication:

1. AC/DC Converter
2. Internal battery. An optional Extra internal battery can be installed to prolong the backup time.

Included in the Battery drawer is also the Power & Communication interface containing:

3. Communication ports
4. PC 1747 CAN/RS232 INTERFACE (CAN = Controlled Area Network)
5. PC 1753 DC/DC CONVERTER
6. PC 1675 POWER SUPPLY
7. PC 1761 MIB CONNECTOR (MIB = Medical Information Bus)
8. PC 1754 CONNECTOR BOARD
9. Communication interface including the small KION Display identity board. These PC boards are also included in the Siemens patient monitor Communication/Power Supply (CPS) module. For further information, see documentation regarding the Communication Power Supply module.





The following cables are connected to the Power & Communication interface :

10. Multi gas module communication cable (RS232)
11. Multi gas module power cable (24 V DC)
12. Overflow screen cable (RS232 & Supply Voltage)
13. CAN loop-back (Service Port)
14. KION Display communication cable (TAXI)
15. AC/DC converter cable
16. Isolation transformer cable (optional).

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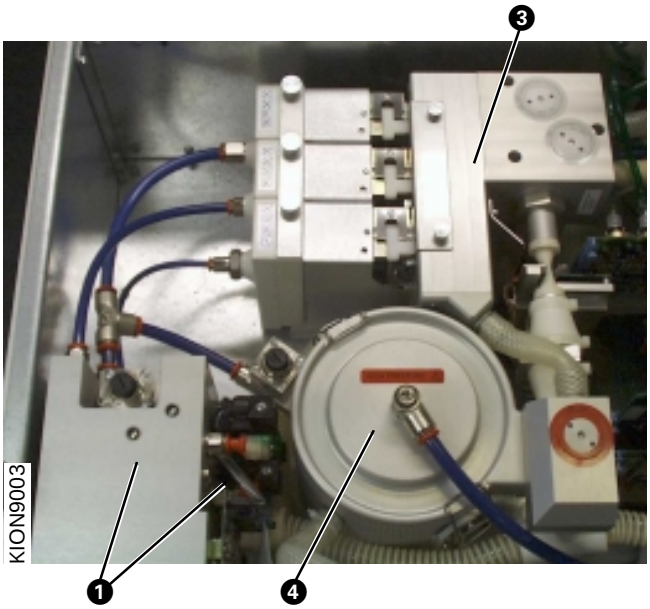
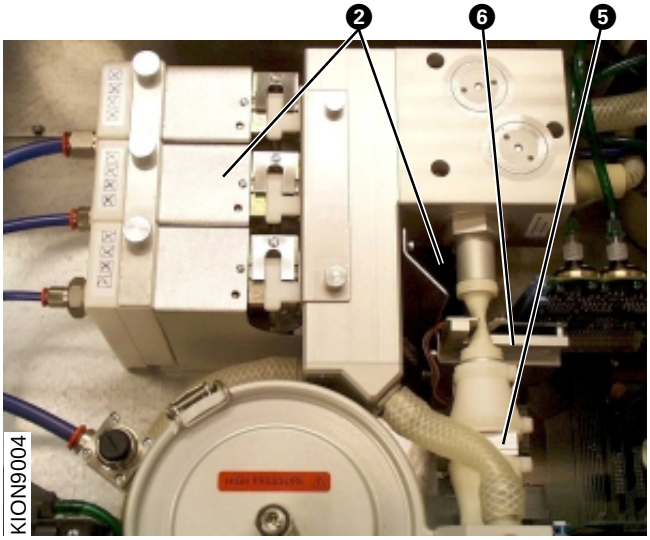
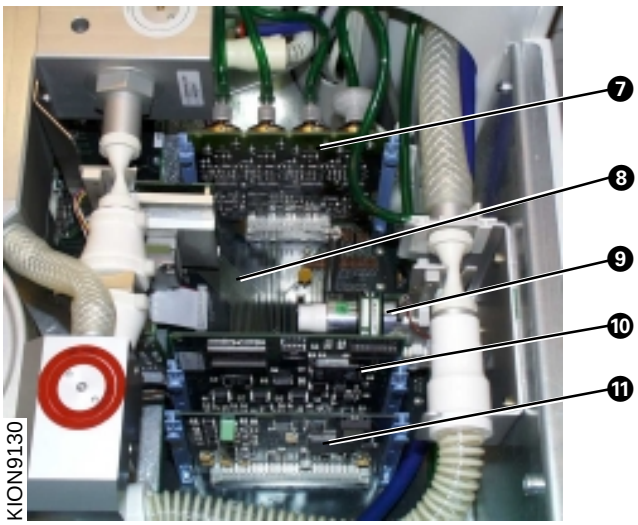






Pneumatic section

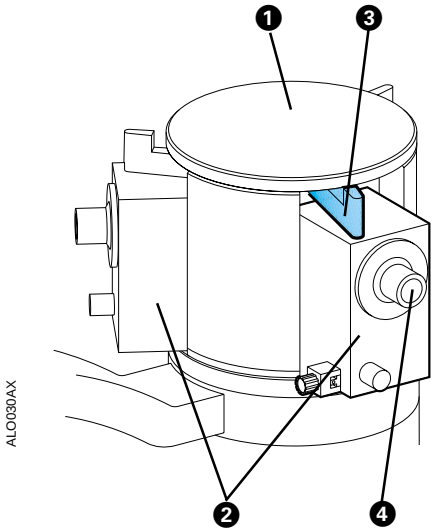
The pneumatic section, accessible when the top cover and shield cover is removed, controls the inspiratory fresh gas flow and the expiratory gas flow.

The main functions are:

1. Gas distribution block with PC 1720 WALL PRESSURE

   Inspiratory control with the:

   2. Gas modules and PC 1765 VALVE INTERCONNECTION
   3. Inspiratory gas block
   4. Fresh gas pressure container
   5. Inspiratory fresh gas flow transducer with PC 1748 FRESH GAS FLOW
   6. Inspiratory fresh gas valve with PC 1751 STEP MOTOR.
7. PC 1750 TRANSDUCER
8. PC 1733 INTERCONNECTION
9. Expiratory valve
10. PC 1730 CONTROL
11. PC 1737 MEASURING.



Vaporizer section

The vaporizers used in the KION System are Presicion Injection Vaporizers, PIVap.

The vaporizers are color-coded for the different anesthetic liquids and filling is key-indexed.

Three vaporizers can be mounted onto the vaporizer magazine. The main functions are:

1. Vaporizer magazine. The magazine can be revolved to facilitate easy access to the active vaporizer.
2. PIVap vaporizers
3. Vaporizer locking lever
4. Vaporizer concentration knob. Only one vaporizer can be active at a time due to the interlocking system. To activate the vaporizer; push-in and turn the vaporizer concentration knob counter-clockwise.

Vaporizers for the following anesthetic agents are available:

- Halothane
- Enflurane
- Isoflurane
- Sevoflurane.

Handle the vaporizers with care when filled with anesthetic liquids. Never turn them upside down or lay them sideways.

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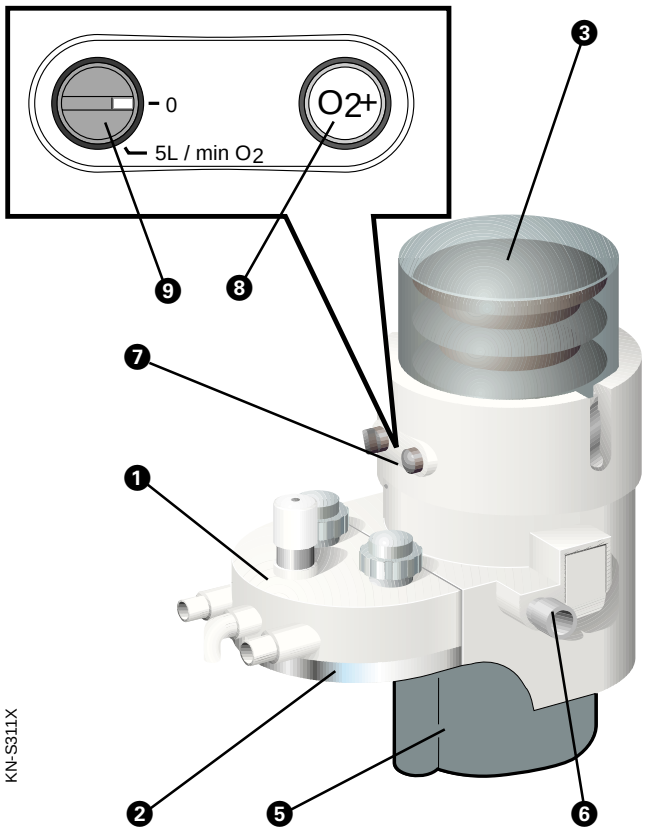

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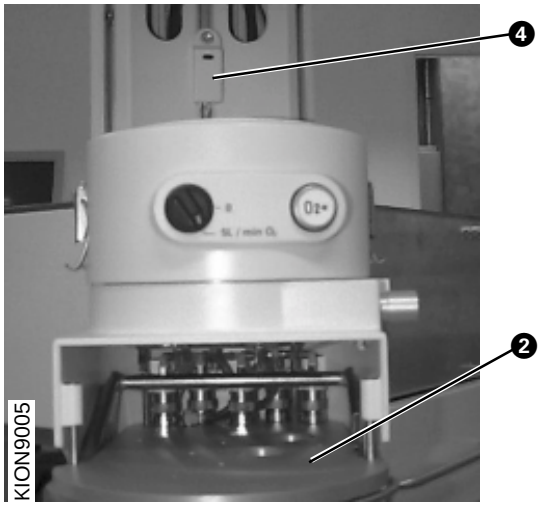
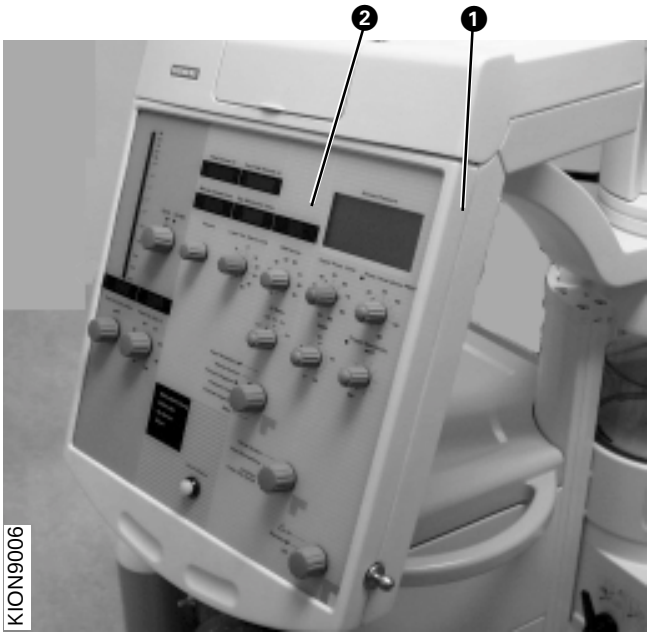


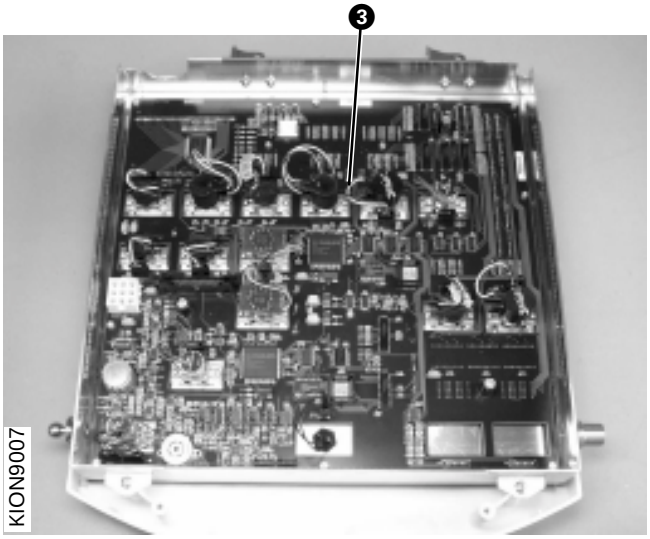
KION9005

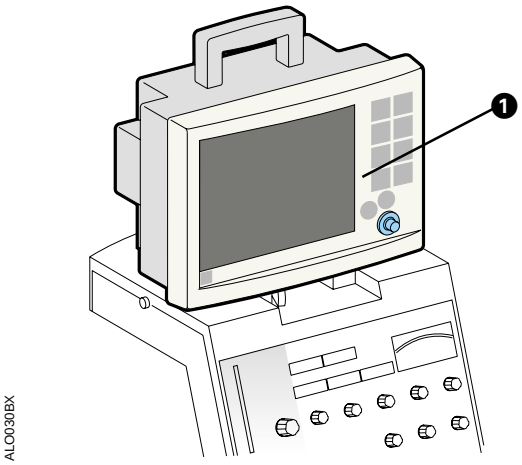
Patient unit

The patient unit controls the gas flow to and from the patient. The main functions are:

1. Patient cassette. Removable unit containing mushroom valves, expiratory flow transducer, inspiratory and expiratory unidirectional valves and the APL valve. The patient tubes and the manual breathing bag are connected to the patient cassette.
2. Support plate for patient cassette. There are five solenoid valves and a mechanically controlled cut-off valve included in the support plate. The solenoid valves are electrically connected to PC 1755 PATIENT CASSETTE VALVE CONTROL.
3. Rebreathing section. The rebreathing bellows and the bellows container are connected to the breathing system when Circle System is selected. A bellows top-position sensor (4) including PC 1766 BNB SENSOR is mounted on the trolley.
5. The CO_2 Absorber purifies the rebreathing gas when Circle System is selected.
6. Auxiliary fresh gas outlet to be used in combination with external breathing systems such as Bain.
7. The section Instant O_2 supply contains the:
   8. O_2 Flush push-button (marked **O_2+**). A gas flow of approx. 50 l/min will be supplied from the O_2 gas supply to the breathing system as long as this button is pressed.
   9. Emergency O_2 switch (marked **5 L/min O_2**). When switched on, it secures a continuous gas flow from the O_2 gas supply of approx. 5 l/min. This function enables manual ventilation, e. g. in case of ventilator malfunction.







User interface

Control panel

The control panel section consists of the:

1. Control panel housing.
2. Front panel in different language versions.
3. PC 1672 CONTROL PANEL.

The control panel selectors and potentiometers are mounted on the control panel housing.

KION Display

The KION Display (1) used is a Siemens patient monitor intended for use with the KION System, e. g. SC 7000, SC 9000 or SC 9000XL. The KION Display, that is mounted on the DOCKING STATION™, will in combination with the Communication Interface, make the KION System an integrated part of the Siemens PICK AND GO™ concept.

The KION Display is used not only for clinical information but also for displaying technical information e. g. during pre-use check, calibration and troubleshooting of the KION System.

For information regarding the KION Display, see the User's guides and the Service Manuals for the Siemens Patient Monitors.

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Optional equipment

Overflow Screen

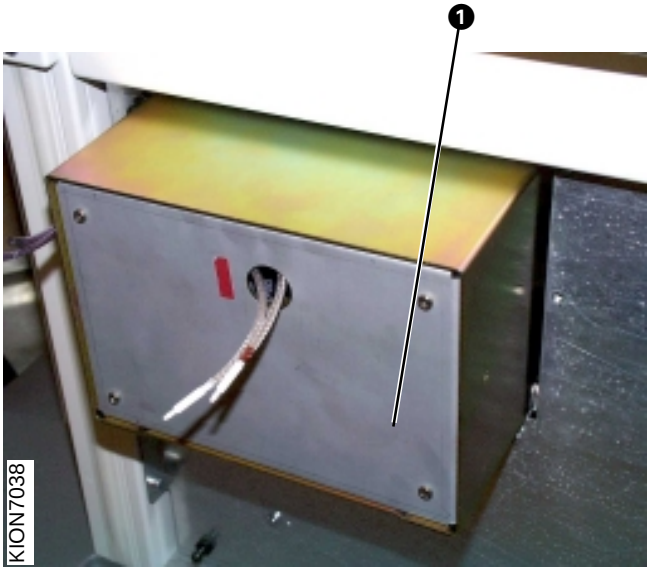
KION7027

For additional monitoring capabilities, an Overflow Screen (DUOVIEW) can be connected to the KION System.

The DUOVIEW is a Surgical Display designed to be an integrated part of the KION System. The DUOVIEW contains the Surgical Display Controller and a VGA Display.

The DUOVIEW is controlled by the KION Display.

Multi-gas module



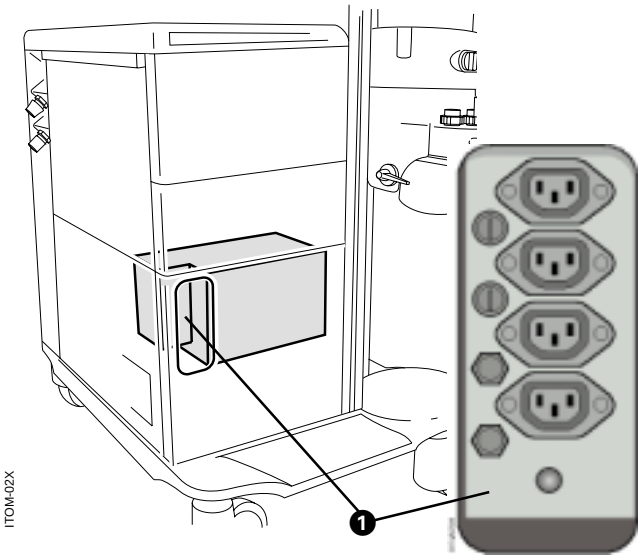
KION7038

As an option, a Multi-gas module (1) can be installed into the KION System. The module to be installed is a modified version of the stand-alone Siemens MULTIGAS+™ Module.

With the Multi-gas module installed, the concentration of the following gases can be displayed on the KION Display:

- O_2 (measured by a fast-acting paramagnetic sensor)
- CO_2
- N_2O
- Anesthetic agent.

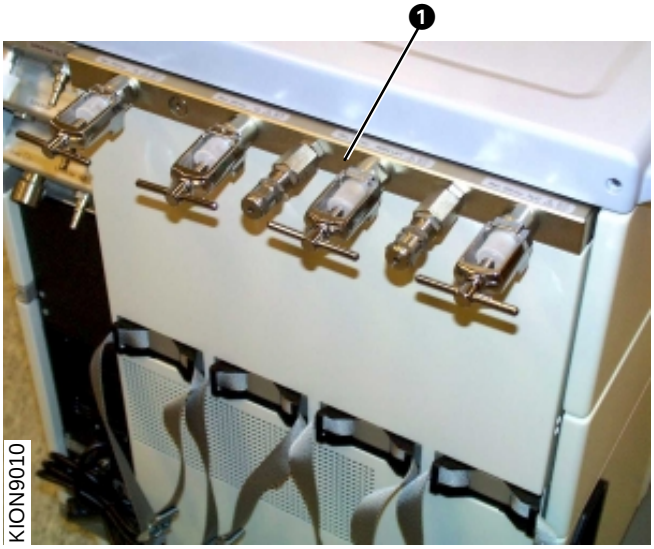
For information regarding the Multi-gas module, see the Service Manual for the Siemens MULTIGAS+ Module.



Isolation Transformer

The KION System can be equipped with an optional KION Isolation Transformer (1) containing four mains power outlet connections and fuses for these outlets. The isolation transformer is available in two versions; 115 V and 230 V.

All equipment connected to the KION System in patient care areas and clinical environments must be separated from the power source by an isolation transformer.



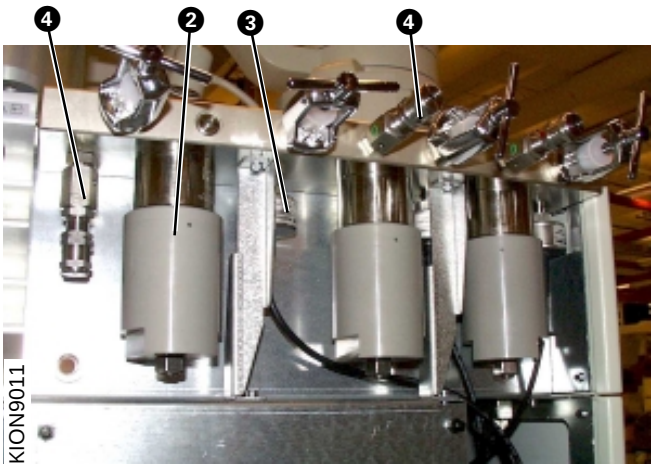
Backup Gas Supply Manifold

The KION System can be equipped with an optional KION Backup Gas Supply Manifold (1) with PIN-index gas connections for 4 gas cylinders.
The gas connections are intended for:

- N_2O (one gas cylinder)
- AIR (one gas cylinder)
- O_2 (two gas cylinders)

The manifold also contains:

2. Pressure regulators. One for each gas.
3. Pressure transducers. One for each gas.
4. Safety valves. One for each gas.



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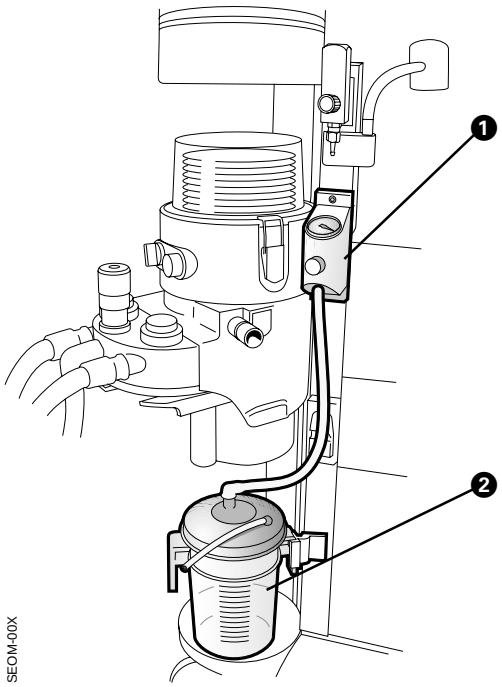
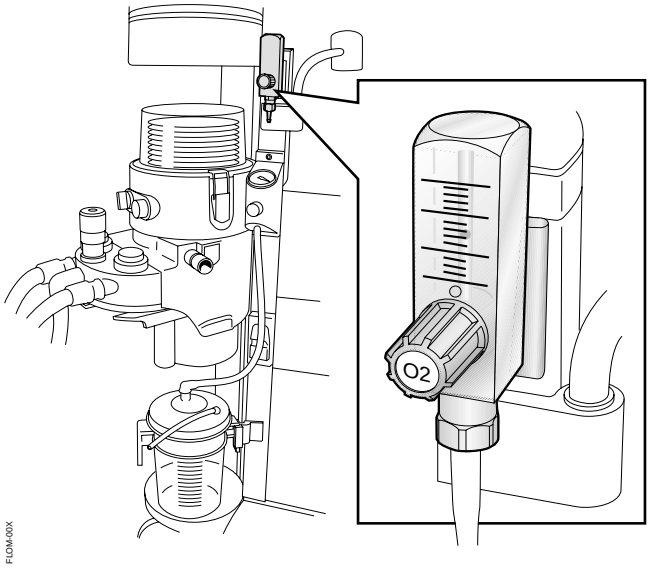


Suction Equipment

The main parts of the optional KION Suction Equipment are:

1. The suction ejector that creates the vacuum. The suction ejector is powered with drive gas from the gas distribution block.
2. The suction bottle where the liquid is collected. The Siemens 1.8 liters suction bottle is recommended.



Auxiliary O_2 Supply

For Auxiliary O_2 Supply, an Auxiliary Oxygen Flowmeter can be mounted onto the KION System.

The flowmeter is supplied with O_2 from the gas distribution block.

Gas evacuation

For evacuation of anesthetic gases from the KION System, the optional Servo Evac 180 can be connected.

Accessory shelf

An optional accessory shelf can be mounted on the KION System. It is not possible to mount the accessory shelf if the KION System is already equipped with a monitor shelf.

Monitor shelf

An optional monitor shelf can be mounted on the KION System. It is not possible to mount the monitor shelf if the KION System is already equipped with an accessory shelf.

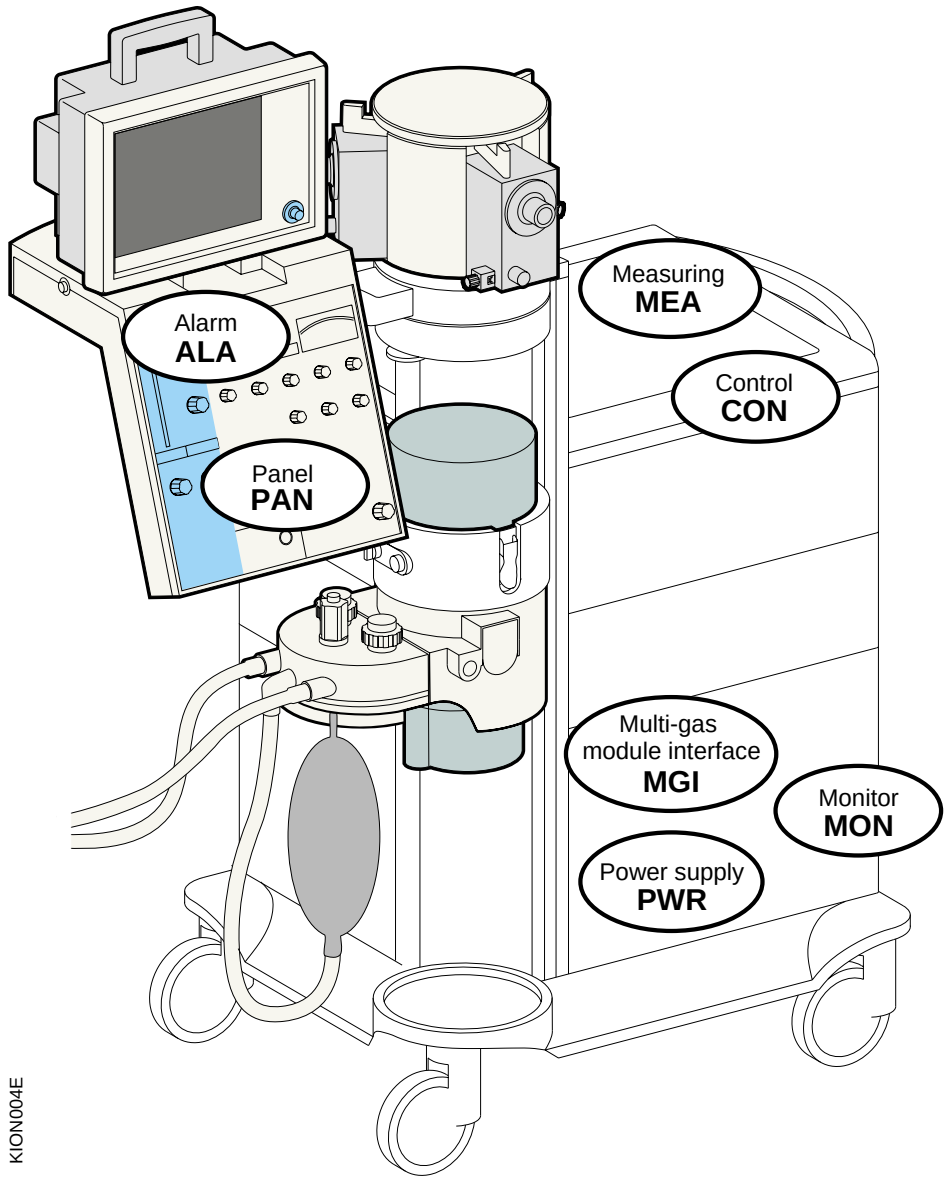
1

Electronic structure

General

The KION software can be divided into the following functional electronic subsystems:

- Panel (PAN)
- Alarm (ALA)
- Measuring (MEA)
- Multi-gas module interface (MGI)
- Monitor (MON)
- Control (CON)
- Power supply (PWR).



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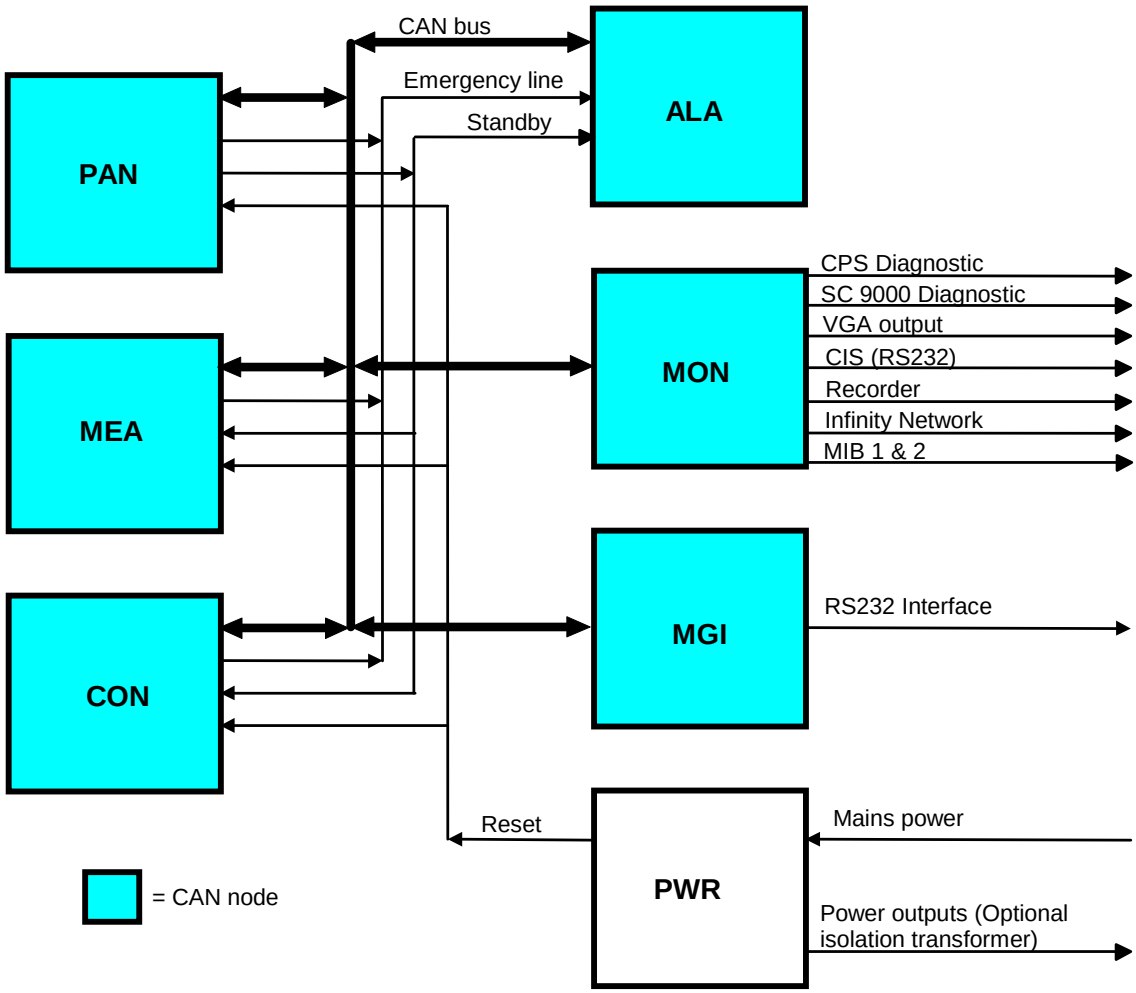
Internal communication

The diagram below shows the basic electrical signals between the different electronic subsystems:



CAN bus

Internal communication via CAN bus protocol.

Emergency line

Digital signal in separate cabel for alarm distribution in case of CAN bus malfunction.

Standby

Digital signal in separate cabel that activates standby functions.

Reset

Digital signal in separate cabel that ensures a controlled start of the microprocessors at a stable voltage level.

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Panel (PAN)

The PAN-software is stored in an exchangable program memory (PAN-PROM) mounted on PC 1672 CONTROL PANEL.

The main functions of the PAN subsystem are:

- Forwarding panel settings to CON and MEA.
- Displaying set and measured parameters.
- Barometer calibration and forwarding of barometric pressure.
- Adjusting display brightness.
- Supervision of ALA.
- Control panel check (displays and LEDs) at startup.

Alarm (ALA)

The ALA-software is stored in an exchangable program memory (ALA-PROM) mounted on PC 1672 CONTROL PANEL.

The main functions of the ALA subsystem are:

- Alarm gateway; transfers alarms from the different subsystems to the MON subsystem for presentation on the KION Display.
- Alarm backup in case of communication error with the KION Display.
- System release at power-up.
- Supervision of power supply.
- Supervision and calculation of battery capacity.
- Supervision of system status (OFF/Standby/ON).
- Supervision of internal CAN-nodes.
- Handling E2PROM-data concerning system configuration.
- Mains/battery indication on the control panel.
- Alarm silencing on the control panel.

Measuring (MEA)

The MEA-software is stored in an exchangable program memory (MEA-PROM) mounted on PC 1737 MEASURING.

The main functions of the MEA subsystem are:

- Measuring, calculation and supervision of expiratory flow (minute and tidal volume).
- Measuring and supervision of airway pressure (software and hardware detection).
- Supervision of gas supply pressure.
- Heating, calibration and zeroing of the expiratory flow transducer.
- Calibration of pressure transducers.
- Supervision of ”Disconnect”.

The measured values are distributed to the correct subsystem via the CAN bus.

MEA handles alarm detection and forwards the alarms to the ALA subsystem. Alarm limits are either constant values or values set on the control panel.

Multi-gas module interface (MGI)

The MGI-software is stored in an exchangable program memory (MGI-PROM) mounted on PC1747 CAN/RS232 INTERFACE.

The main functions of the MGI subsystem are:

- Protocol converter between KION (CAN) and Multi-gas module (RS232).
- Startup of Multi-gas module.

Monitor (MON)

The Monitor (MON) subsystem includes the:

- Communication interface (CPS Network PCB).
- PC 1754 Connector.
- PC 1761 MIB Connector.
- KION Display.

The Communication interface including the small KION Display identity board is also included in the Siemens SC 9000 module Communication Power Supply (CPS).

The software, CPS-SW in the Communication interface and KION DISPLAY-SW in the KION Display, is installed from a PC Card via the KION Display.

The main functions of the MON subsystem are:

- Displaying patient parameters and wave forms.
- Displaying gas supply pressures.
- Displaying set and measured gas concentrations.
- Displaying alarms.
- Handling external communication.

Control (CON)

The CON-software (CON-SW) is stored in a FLASH-PROM on PC 1730 CONTROL.

The main functions of the CON subsystem are:

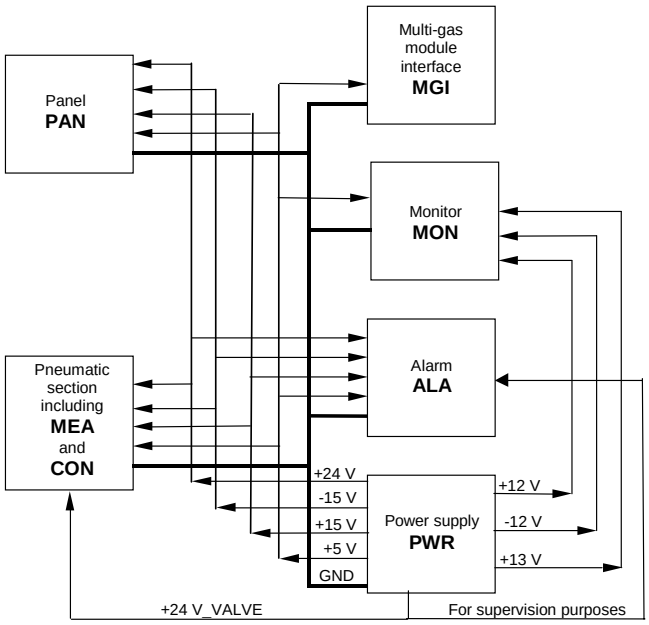
- Control of breathing systems.
- Control of ventilation modes.
- Control and measuring of fresh gas flow including gas mixture selection (O_2/AIR, O_2/N_2O).
- Calculation of inspiratory flow.
- Calculation of spontaneous breathing frequency.
- Conversion of panel settings and feedback to panel.
- Controlling the "Pre-use check" and the "Calibration" sequences.
- Control of all electromagnetic valves.

Power supply (PWR)

The Power supply (PWR) subsystem includes the:

- AC/DC Converter.
- Internal battery.
- PC 1753 DC/DC CONVERTER.
- PC 1675 POWER SUPPLY.
- Isolation transformer (if connected).
- Control of power up and power down sequences

The Power supply subsystem is responsible for converting mains power and battery power to the voltage levels requested by the system. Power supply will also supply these voltages to the electrical parts within the system.



Notes

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2. Description of functions

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2

About this chapter

This functional description is divided in two levels:

Basic principles containing a survey of the function. This text is written with an italic typeface. The text refers to the diagram "Basic principles" in chapter 8. "Diagrams".

Enhanced information about the function. Normal typeface is used in this text. This text refers to the following diagrams in chapter 8. "Diagrams":

- "Pneumatic section"
- "Patient unit and vaporizer section"
- "Electronic interconnection".

Text written in SMALL CAPS refers to block names in the diagrams mentioned above.

Battery drawer

The battery drawer contains functions for power supply and communication.

1. AC/DC Converter

The AC/DC CONVERTER, containing the mains power rectifier and the transformer, is a complete unit that is mounted on the Power & Communication interface casing. The AC/DC CONVERTER is electrically connected to PC 1675 POWER SUPPLY.

There are two mains power inlet fuses in the AC/DC CONVERTER. The fuses and the AC/DC CONVERTER FAN are the only spare parts available for the AC/DC CONVERTER.

The AC/DC CONVERTER FAN pulls cooling air into the converter compartment. If the fan fails, the signal FAN_FAIL generates a diagnostic log message.

If the AC/DC CONVERTER is overheated (above +90°C / 194°F), e. g. due to fan failure, the AC/DC CONVERTER will be disabled. The KION SYSTEM will then be power supplied by the INTERNAL BATTERY. When the AC/DC CONVERTER cools down, it will automatically be enabled.

Technical data for the AC/DC CONVERTER:

- AC/DC CONVERTER input: 100 – 240 V AC, 50 – 60 Hz.
- AC/DC CONVERTER output: Max. 400W, ouput voltage level 21 – 30 V DC controlled by analog signal from the Charging/Discharging control block on PC 1675 POWER SUPPLY.
- Fuses: T 6.3 AL / 250 V AC (2 pcs).

2. Internal battery

The INTERNAL BATTERY (two serial connected 12 V sealed lead acid batteries) supplies the KION System with backup power for min. 30 minutes with full loaded battery.

The INTERNAL BATTERY is used as an internal 24 V backup. The batteries are rated 12 V, approx. 24 Ah. Tested batteries for use in KION are:

- HITACHI HP24-12
- VARTA, Type accu-CF
- NEWMAX, Type FNC 12240
- CSB, Type EVX-12260.

No other batteries must be used.

The INTERNAL BATTERY is continously charged when the KION System is connected to mains power. Charging time for empty batteries is approx. 6 hours.

The actual INTERNAL BATTERY capacity is continously displayed on the KION Display. The battery capacity indication, bargraph with %, is related to actual battery voltage. "100%" is indicated when trickle charge level is reached (fully charged).

The following applies concerning battery voltage supply:

- Battery voltage supply is used as soon as the AC/DC CONVERTER voltage is less than the battery voltage (e.g. at loss of mains power).
- If the AC/DC CONVERTER output voltage is below 19 V (e.g. at loss of mains power), a "Switching to battery" alarm indicates that battery voltage supply is in use.
- First battery alarm "Limited battery capacity" is activated when battery voltage reaches below 23 V or 22 V if an EXTRA INTERNAL BATTERY is connected. These voltage levels correspond to "20%" indicated.
- Second battery alarm "No battery capacity" is activated 10 minutes after first battery alarm or when battery voltage is below 22 V or 21.5 V if an EXTRA INTERNAL BATTERY is connected. These voltage levels correspond to "0 %" indicated.
- All functions will be cut off when battery voltage reaches below 21 V.

Battery capacity indication and alarms are generated via the ALA power supervision function.

Service interval for the INTERNAL BATTERY:

- The INTERNAL BATTERY must be checked during the "Twelve months maintenance".
- The INTERNAL BATTERY must be replaced every three years. After replacement, allow the batteries to recharge before clinical use of the Kion System.

The lifetime of the INTERNAL BATTERY is reduced if it is used frequently to supply the KION System with operating power or if the battery temperature is above +50°C (122°F) e. g. due to BATTERY DRAWER FAN failure. In such case, it is recommended to check the INTERNAL BATTERY with shorter intervals than 12 months.

3. Extra internal battery (optional)

EXTRA INTERNAL BATTERY (two serial connected 12 V sealed lead acid batteries) for extended backup time. Gives, together with the INTERNAL BATTERY, a total backup time of approx. 120 minutes with full loaded battery.

For information regarding battery type, function and service interval, see section 2. "Internal battery" above.

There are two versions of the battery cable; one version to be used if a standard INTERNAL BATTERY is connected and one version to be used if an EXTRA INTERNAL BATTERY is connected. Thus, if an extra EXTRA INTERNAL BATTERY is connected (or disconnected), the battery cable must be replaced.

4. Power & Communication Interface

The following functions are included in the POWER & COMMUNICATION INTERFACE:

- *Communication ports – PC 1754 CONNECTOR.*
- *PC 1761 MIB CONNECTOR.*
- *COMMUNICATION INTERFACE (CPS network PCB).*
- *PC 1747 CAN/RS232 INTERFACE.*
- *PC 1753 DC/DC CONVERTER. Generates +12 V, +13 V and a fused +24 V for power supply of the KION System.*
- *PC 1675 POWER SUPPLY. Voltage supply and battery charge/capacity check. Generates +15 V, - 15 V and +5 V.*
- *BATTERY DRAWER FAN.*

Communication ports – PC 1754 Connector

Communication ports for connecting the KION System to network, service options, etc. The communication ports are integrated parts of PC 1754 CONNECTOR.

Pin configuration and signal names can be found in chapter 8 "Diagrams".

PC 1761 MIB Connector

The PC 1761 MIB CONNECTOR converts monitoring parameters to MIB protocol. (MIB = Medical Information Bus.)

Pin configuration and signal names can be found in chapter 8 "Diagrams".

Communication interface (CPS network PCB)

Communication interface including the small KION display identity board. These PC boards are also included in the Siemens patient monitor Communication/Power Supply (CPS) module.

The CPS-software (CPS-SW) is installed from a PC Card via the SC 7000 / SC 9000 / SC 9000XL.

PC 1747 CAN/RS232 Interface

Protocol converter between KION (CAN) and MULTI GAS MODULE (RS232).

The MGI-software is stored in an exchangable program memory (MGI-PROM) mounted on PC 1747 CAN/RS232 INTERFACE.

PC 1753 DC/DC Converter

This description also refers to the block diagram "Power supply – Main functions" below.

PC 1753 DC/DC CONVERTER is supplied with +24 V from PC 1675 POWER SUPPLY and generates:

- +12 V to connected equipment (lamp, recorder, MIB, CPS Diagnostic and Overflow screen).
- +13 V to the KION Display.
- A fused +24 V to the MULTI GAS MODULE.

There are three fuses on PC 1753:

- F1/PC 1753 = 15 A / 32 V. Cuts the +24 V power supply to the DC/DC CONVERTER 24/12 V which disables the +12 V power supply to connected equipment. No alarm is activated.
- F2/PC 1753 = 15 A / 32 V. Cuts the +24 V power supply to the DC/DC CONVERTER 24/13 V which disables the +13 V power supply to the KION Display. The KION Display will run on its internal battery and alarm is activated.
- F3/PC 1753 = 7.5 A / 32 V. Cuts +24 V power supply to the MULTI GAS MODULE. Alarm is activated.

PC 1675 Power Supply

This description also refers to the block diagram "Power supply – Main functions" below.

The main functions are:

- Generates and distributes +15 V, - 15 V and +5 V to the different KION subsystems. Also generates +12 V and -12 V for the COMMUNICATION INTERFACE (CPS) via linear regulators.
- The Logic & Timing block handles different time delays for voltages at Power On:
  - The input signal MEAS_INHIBIT comes from ALA in order to stop the battery capacity check.
  - The input signal DISABLE_VALVES comes from ALA, CON or MEA in order to disable +24 V_VALVE (stop power supply to gas modules) e.g. at upper pressure alarm.
- Power supply to gas modules, +24V_VALVE, will also be cut at Low battery voltage or at System Off.
- BATTERY DRAWER FAN is power supplied by +24V_FAN.
- Power supervision function in the ALA subsystem and PATIENT CASSETTE VALVE CONTROL is power supplied by +24V_PTC.
- Battery status and measure signals from the block Charging/Discharging control is supplied to ALA.
- Power supply of the system will be cut at Low battery voltage or at System Off.

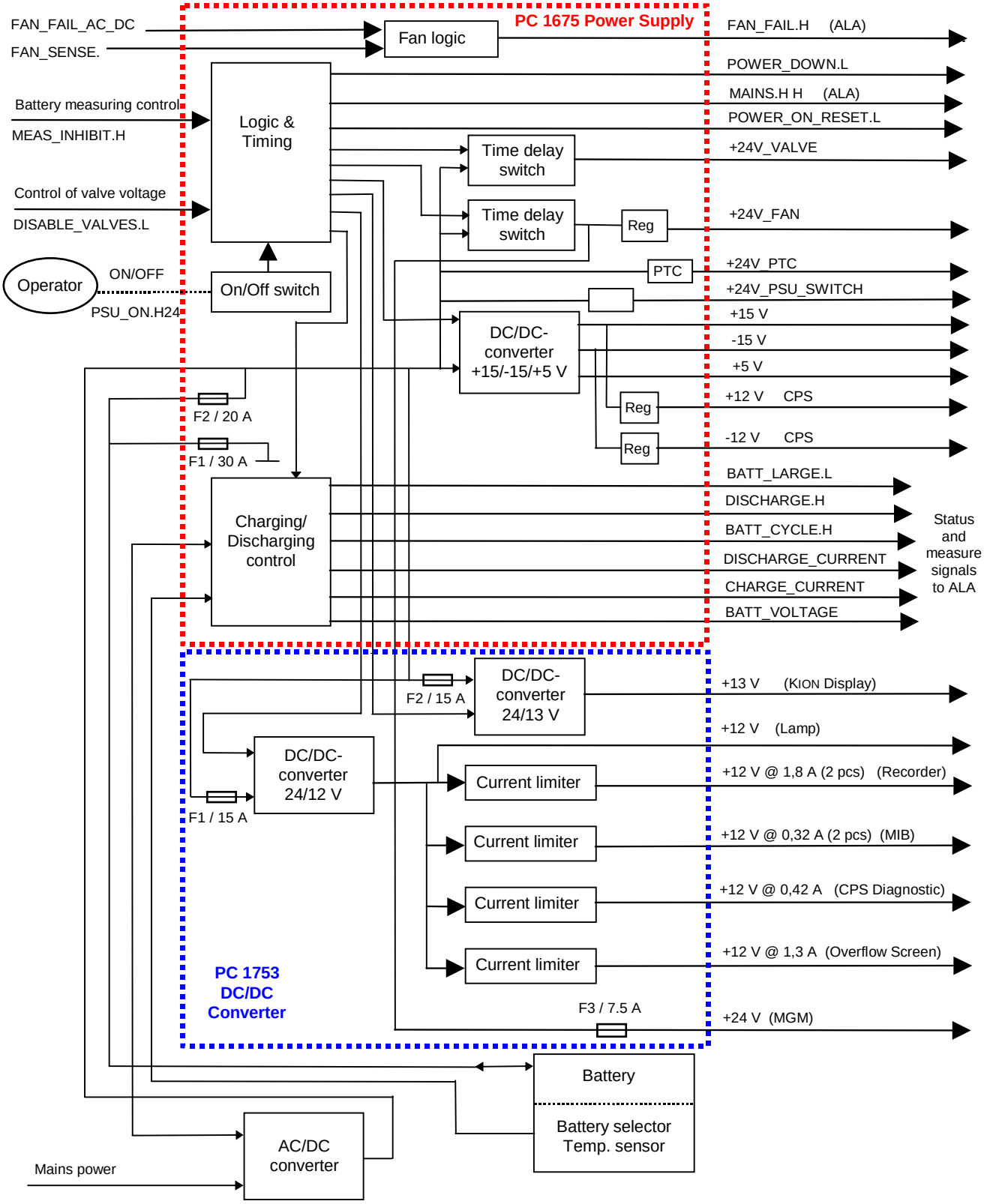
There are two fuses on PC 1675:

- F1/PC 1675 = 30 A / 32 V. Battery short-circuit protection. The internal battery is disconnected and alarm is activated.
- F2/PC 1675 = 20 A / 32 V. Protects the internal battery from failures on PC 1675. The internal battery is disconnected and alarm is activated.

Battery Drawer Fan

The BATTERY DRAWER FAN pulls air out of the battery drawer compartments. If the fan fails, the signal FAN_FAIL generates a diagnostic log message.

If the temperature in the battery drawer compartment is above 45 – 50°C (113 – 122°F), e. g. due to BATTERY DRAWER FAN failure, the function of the MULTI GAS MODULE and the lifetime of the INTERNAL BATTERY may be affected.



Block diagram: Power supply – Main functions

Pneumatic section

5. Gas distribution block

Gas supply from hospital central gas supply and/or from gas cylinders are connected to this block. The main functions are:

- *Three gas inlets to connect gas from the hospital central gas supply.*
- *PC 1720 WALL PRESSURE mounted on the block measures the hospital central gas supply pressures.*
- *The breathing gas and drive gas delivered to the KION System subunits are electronically and pneumatically controlled by the GAS SELECTION VALVES.*
- *The two preset pressure regulators mounted on the GAS DISTRIBUTION BLOCK regulates the pressure in the gases delivered to the patient cassettes mushroom valves and to the block INSTANT O_2 SUPPLY.*
- *A number of gas inlets and outlets for connection of optional equipment to the KION System.*

Gas inlets

Three quick-couplings to connect gas from the hospital central gas supply. The design of the gas inlet nipples and the color marking of the inlets varies according to different national standards. The gas inlet channels (inside the gas distribution block) are equipped with gas inlet filters and spring loaded one-way valves, OV1 – OV3. The filters must be replaced during the "Twelve months maintenance".

PC 1720 Wall Pressure

There are two main functions on PC 1720 WALL PRESSURE:

- Three pressure transducers including amplifiers. Measures the pressure in the gases connected to the gas inlets (from the hospital central gas supply). There are no tube connections to the transducers, the PC board is mounted firmly onto gas outlets in the GAS DISTRIBUTION BLOCK. The gas outlets are equipped with seals to prevent leakage between the GAS DISTRIBUTION BLOCK and the PC board.
- Valve driver, a drive stage for the gas selection valves EMV6 and EMV7.

Gas selection valves

The different gases delivered to the GAS MODULES are controlled as follows in the GAS DISTRIBUTION BLOCK:

- Gas going to GAS MODULE AIR (N_2O) – BP: Controlled by the solenoid valve EMV6. AIR or N_2O breathing gas depending on settings on the control panel. Cuts automatically the N_2O supply if O_2 supply pressure drops below 200 kPa (2.0 bar).
- Gas going to GAS MODULE O_2 – BP: Only O_2. The O_2 breathing gas is delvered directly to the GAS MODULE O_2 – BP and is not controlled by any solenoid valve on the GAS DISTRIBUTION BLOCK.
- Gas going to GAS MODULE – DRIVE GAS – AIR (O_2): Controlled by the solenoid valve EMV7. Supplies normally AIR but changes automatically to O_2 if the AIR supply pressure drops below 200 kPa (2.0 bar) or if the solenoid valve drive voltage fails.

Pressure regulators

There are two preset pressure regulators mounted on the GAS DISTRIBUTION BLOCK:

- REG1 regulates the pressure in the mushroom valve control gas supply (AIR or O_2 depending on EMV7 mode) used by EMV1 – 5. The preset pressure is 20 kPa (0.2 bar).
- REG2 regulates the pressure in the breathing gas (O_2) to the block INSTANT O_2 SUPPLY. The preset pressure is 250 kPa (2.5 bar).

Backup gas inlets

The GAS DISTRIBUTION BLOCK is equipped with three backup gas inlets used when gases from the optional BACKUP GAS SUPPLY MANIFOLD are connected. These inlets are plugged if not used.

Gas outlets for auxiliary equipment

There are two extra gas outlets on the GAS DISTRIBUTION BLOCK, one for O_2 and one for AIR. These outlets can be used to supply optional equipment, such as AUXILIARY O_2 SUPPLY and SUCTION EQUIPMENT, with O_2 and AIR.

6. Inspiratory control

Controls the gas delivered to the breathing system. The main functions are:

- *The three GAS MODULES. They are basically of the same design and function as the gas modules (inspiratory valves) in the Servo Ventilator 300.*
- *Four safety valves, SV1 – 4.*
- *FRESH GAS PRESSURE CONTAINER to create the working pressure for the fresh gas supply.*
- *Inspiratory fresh gas channel that measures and controls the fresh gas to the breathing system.*

Gas modules

There are two different versions of the gas module:

- Version A recognized by the metal nozzle unit.
- Version B recognized by the plastic nozzle unit.

Version B will replace Version A in the production of KION Systems during the second half of 1999. Date and/or Serial No. for this change in production is not yet descided. If not stated otherwise, this functional description is valid for both versions.

The three GAS MODULES are:

- GAS MODULE AIR (N_2O) – BP supplies AIR or N_2O to the VAPORIZER MAGAZINE.
- GAS MODULE O_2 – BP supplies O_2 to the VAPORIZER MAGAZINE.
- GAS MODULE – DRIVE GAS – AIR (O_2) supplies AIR or O_2 as drive gas to the REBREATHING SECTION.

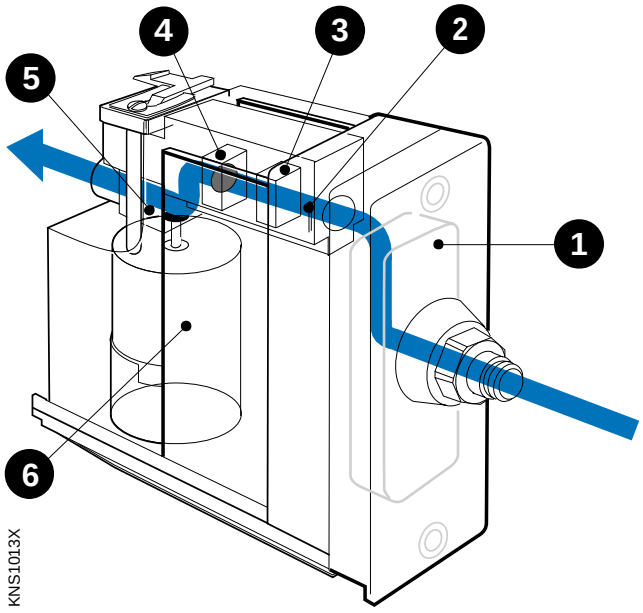
The GAS MODULES marked BP are modified to handle the backpressure created when supplying fresh gas to vaporizers. Max. flow from the gas modules modified for backpressure is reduced to 2 l/s.
The modification concerns PC boards inside the gas module and the nozzle unit. Without these modifications, the backpressure would disable the diaphragms closing function.

The GAS MODULES are pneumatically connected to the INSPIRATORY GAS BLOCK and electrically connected to PC1765 VALVE INTERCONNECTION.

The GAS MODULES are factory calibrated.

The adjustment potentiometer located at the top of each GAS MODULE (Version A) must not be adjusted.

Each GAS MODULE must not be disassembled further than described in chapter 6 "Twelve months maintenance".



1. Bacteria filter
2. Inspiratory valve temperature sensor
3. Supply pressure transducer
4. Flow transducer (Delta pressure transducer and net)
5. Nozzle unit with valve diaphragm
6. Inspiratory solenoid

Air inlet

Gases from the GAS DISTRIBUTION BLOCK are connected to the inlet tube connectors on the GAS MODULES. The tube connectors and the corresponding tubes have different diametres to prevent faulty gas connections.

The filter housing and the filter cover is provided with matching guide pins. These guide pins prevents mounting the filter cover (with inlet tube connectors) on wrong GAS MODULE.

A non-return valve for the gas inlet is located in the inlet filter cover. This valve will suppress short pressure drops in the gas supply. The non-return valve is also designed to slowly evacuate compressed gas from the GAS MODULE if the gas supply to the GAS MODULE is disconnected.

Bacteria filter

The bacteria filter protects the system from bacteria and particles in the gas delivered to the air inlet. The bacteria filter must be replaced during the "Twelve months maintenance".

Inspiratory valve temperature sensor

The temperature of the supplied gas is measured by the inspiratory valve temperature sensor. This sensor is situated in the gas flow.

The output signal from this sensor is used to compensate for the gas density variations due to temperature.

Supply pressure transducer

The pressure of the supplied gas is measured by the supply pressure transducer.

The output signal from this transducer is amplified. It is then used to calculate the absolute pressure of the gas to compensate for gas density variations due to pressure.

Delta pressure transducer and net

The gas flows through a net (resistance) which causes a pressure drop. The pressure is measured on both sides of this net and the differential pressure value is then amplified.

Nozzle unit

The nozzle unit contains a valve diaphragm. The valve diaphragm, controlled by the inspiratory solenoid, regulates the gas flow through the GAS MODULE.

Metal nozzle units (Version A) modified for back-pressure must be used together with a small washer that is places on top of the inspiratory solenoid. This washer will support the diaphragm and distributes the backpressure over a larger area on the diaphragm. This function is integrated in the plastic nozzle units (Version B) and the small washer is not used in these GAS MODULES.

The nozzle units are provided with a mechanical key to prevent that the nozzle unit is mounted into wrong GAS MODULE.

An O-ring and the valve diaphragm (Version A) or the complete plastic nozzle unit (Version B) must be replaced during the "Twelve months maintenance". After replacement, allow the diaphragm to settle during approx. 10 minutes before gas pressure is connected to the GAS MODULE.

Inspiratory solenoid

The gas flow through the GAS MODULE is regulated by the inspiratory solenoid via the nozzle unit.

The current supplied to the solenoid is regulated so that the gas module will deliver a gas flow according to the front panel settings.

Gas module key

The GAS MODULES are provided with a mechanical key to prevent that the GAS MODULE is mounted in the wrong slot.

The key consists of a plastic guide mounted underneath the GAS MODULE and a corresponding guide mounted on the pneumatic section base.

Safety valves

The INSPIRATORY CONTROL block contains four safety valves:

- SV1 is a spring loaded valve preset to open at 180 kPa (1.8 bar). Protects the vaporizers in case of failure in the GAS MODULES AIR (N_2O) – BP or O_2 – BP.
- SV2 is a magnetic valve preset to open at 14 kPa (140 mbar). Will release overpressures created in the REBREATHING SECTION, e. g. if the patient is coughing. Will also protect the REBREATHING SECTION in case of failure in the GAS MODULE – DRIVE GAS – AIR (O_2).
- SV3 is a magnetic valve preset to open at 18 kPa (180 mbar). Protects the FRESH GAS PRESSURE CONTAINER and the INSPIRATORY FRESH GAS VALVE.
- SV4 is a magnetic valve preset to open at 14 kPa (140 mbar). Protects the patient from high pressure in the fresh gas.

The magnetic valves (SV2 – SV4) contain a permanent magnet that affects the metal valve cone. The distance between the magnet and the valve cone is preset to open the valve when the pressure limit is reached.

Fresh gas pressure container

The fresh gas from the VAPORIZER MAGAZINE enters the FRESH GAS PRESSURE CONTAINER above the big rubber diaphragm mounted inside the container. A piston, that is pushed up by the constant gas pressure regulated by REG3, affects the diaphragm and the fresh gas is pushed out from the FRESH GAS PRESSURE CONTAINER. The preset pressure on REG3 is 100 kPa (1.0 bar).

PC 1752 DIAPHRAGM POSITION SENSOR inside the container, in combination with two magnetic washers inside the piston, indicates the position of the piston, i. e. if the container is full. This level signal is used to enable and to disable the GAS MODULES for a flow of fresh gas to the vaporizers.

The diaphragm and the piston seal must be replaced during the "Twelve months maintenance".

Inspiratory fresh gas channel

The fresh gas passes:

- The inspiratory fresh gas flow transducer with PC 1748 FRESH GAS FLOW (amplifier).
- The INSPIRATORY FRESH GAS VALVE with PC 1751 STEP MOTOR (control function).
- The one-way valve OV4.

O_2 from the block INSTANT O_2 SUPPLY is connected to the channel for fresh gas to breathing system in the INSPIRATORY GAS BLOCK.

Inspiratory fresh gas flow transducer

The gas flows through the flow transducer in two parallel channels, one large main channel and one small measuring channel. The main channel is fitted with a wire mesh net, the resistance of which causes a certain proportion of the gas to flow through the measuring channel. The flow through and the differential pressure across the measuring channel acts on a small metal disc ("flag") which, via a metal pin, presses on a small semiconductor strain gauge.

This strain gauge consists of diffused resistors on both sides of an elastic silicone rod. The resistors are connected as a part of a Wheatstone bridge, the other part of which is situated on PC 1748 FRESH GAS FLOW. The more flow in the channel, the higher the pressure on the strain gauge. The change in resistance in the Wheatstone bridge is converted to a corresponding signal voltage.

Cleaning of the flow transducer is described in chapter "Routine cleaning" in the Operating Manual.

Inspiratory Fresh Gas Valve with PC 1751 Step Motor

The INSPIRATORY FRESH GAS VALVE is operated by a step motor with a special shape slotted cam mounted on the motor shaft.

The gas flows through the fresh gas valve tube (silicone rubber) that is a part of the inspiratory fresh gas channel. The gas flow through the valve tube is then controlled by a movable lever arm that squeezes the valve tube against a fixed arm. This movable arm is attached to the cam and transfers the step motors rotation to a controlled opening position of the valve tube.

The change in flow through the valve tube is micro-step controlled by the step motor. The step motor is controlled by PC1751 that is a part of the step motor assembly.

PC1751 STEP MOTOR is equipped with two LEDs and two photo detectors. When the step motor reaches either end position of the cam slot, the light beam between the LED and the corresponding photo detector is interrupted by a cam screen. The cam screen is a part of the slotted cam mounted on the motor shaft. This will generate an end position signal from PC 1751.

The position of the LEDs / detectors in relation to the cam screen is very important. If a LED / detector gets out of position, or if they fail, this will cause the step motor to ”rattle” because end positions are not properly indicated.

When power supply to the INSPIRATORY FRESH GAS VALVE is switched off (or if the power supply fails), the step motor will always end up with the inspiratory valve in fully opened position.

The fresh gas valve tube must be replaced during the ”Six months maintenance” and the ”Twelve months maintenance”.

7. Expiratory valve

The expiratory gas flow is controlled by the EXPIRATORY VALVE. This valve also controls PEEP if a PEEP pressure is set on the CONTROL PANEL.

The EXPIRATORY VALVE comprises a spring loaded pull magnet acting on a lever arm which squeezes the expiratory valve tube (silicone rubber) against a fixed arm. The more the magnet is activated, the more the valve will move towards the closing position.

When power supply to the magnet is switched off, the valve will be fully opened because of the spring. This ensures that the patient always can exhale through the ventilator at a power failure.

The expiratory valve is controlled by CON. At a PEEP setting, information from the PEEP pressure transducer is used to regulate the valve position during expiration.

The expiratory valve tube must be replaced during the ”Six months maintenance” and the ”Twelve months maintenance”.

8. PC 1733 Interconnection

The PC 1733 INTERCONNECTION electrically connects a number of units in the KION System. The only electronic functions on this PC board are output filters and PTC resistors.

Three PC boards are mounted in PC board connectors on the upper side of the PC 1733:

- PC 1730 CONTROL
- PC 1737 MEASURING
- PC 1750 TRANSDUCER

The under side of PC 1733, accessible behind a trolley cover, contains cable connectors for the:

- Patient unit cable.
- Pneumatic section cable.
- Control panel cable.
- Pressure transducers on the optional BACKUP GAS SUPPLY MANIFOLD.

The PC board inputs/outputs are described in chapter 8. "Diagrams".

9. PC 1730 Control

Controls flow, pressure, composition and concentration in the gas delivered to the patient. All ventilation mode functionality is controlled by this unit.

PC 1730 CONTROL contains a microprocessor that executes the CON-software (CON-SW) that is stored in a FLASH-PROM.

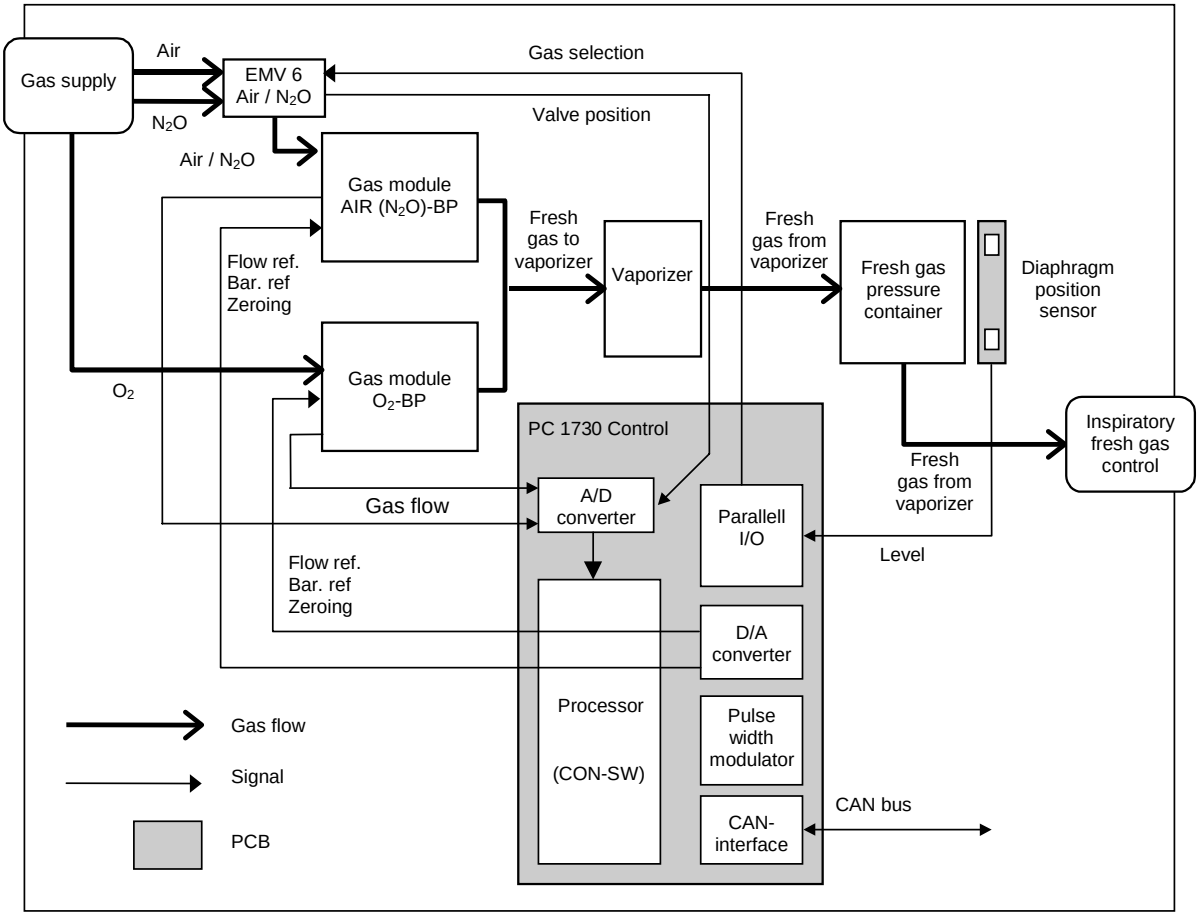
The main functions of PC 1730 CONTROL are:

- *General parameters (used or created by CON).*
- *Fresh gas production (excluding control of anesthetic agent type and concentration).*
- *Inspiratory fresh gas control.*
- *Drive gas for rebreathing.*
- *Regulation of expiration.*

General parameters

Some of the general parameters used or created by CON are:

- **Pressure**: Input pressure signals from the four pressure transducers on PC 1750 are supplied via the A/D CONVERTER for regulation of inspiration and expiration.
- **Timing**: Output Insp. time and Exp. time signals are generated. These are used by MEA to control zeroing of the flow transducers.
- **Fresh gas outlet**: Input signal from the Hall sensor in the AUXILIARY FRESH GAS OUTLET indicates when the valve is opened. This signal is used to light up a LED on the CONTROL PANEL.
- **Pressure alarm**: Input signal from MEA indicating that upper pressure limit is reached. Used to stop inspiration time and immediately start expiration time. This will open the EXPIRATORY VALVE and to set the other valves in safe positions.



Block diagram: PC 1730 – Fresh gas production

Fresh gas production

Fresh gas production depends on the following settings:

- Selection of gas mixture – O_2/Air or O_2/N_2O.
- Preset O_2 concentration.
- Anesthetic agent – type and concentration.

Air/N_2O selection

Information about gas combination selected on the CONTROL PANEL, O_2/Air or O_2/N_2O, is distributed via the CAN bus to PC 1730 CONTROL.

The electrically and pneumatically operated EMV 6 activates the selection. The switching of EMV 6 is monitored.

Gas Modules

Two of the GAS MODULES delivers fresh gas to vaporizers according to the O_2 concentration set on the CONTROL PANEL.

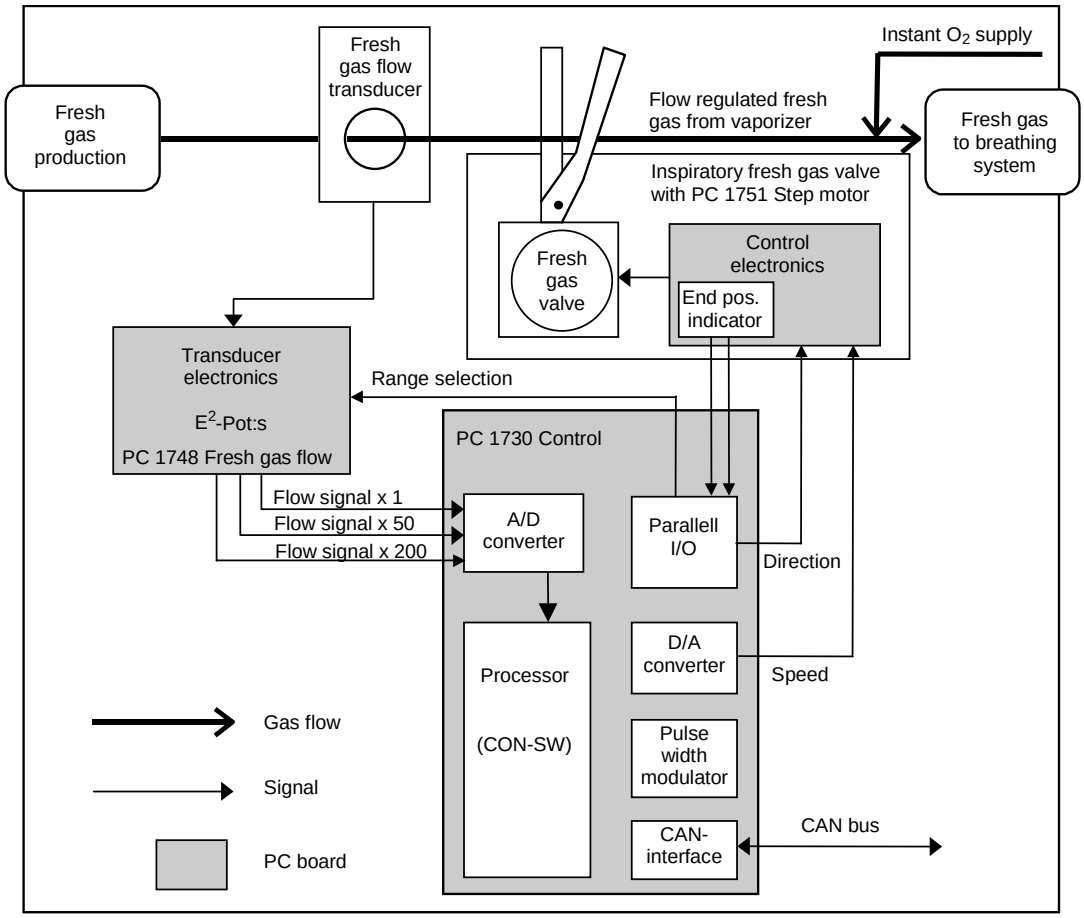
The control signals, delivered from the D/A converter on PC 1730 CONTROL to the GAS MODULES, are:

- Flow reference (ATP signal).
- Barometric pressure reference.
- Zeroing of flow transducer.

Each GAS MODULE creates its gas flow signal which is sent back to PC 1730 CONTROL.

Fresh Gas Pressure Container

The level signal from the DIAPHRAGM POSITION SENSOR indicates if the FRESH GAS PRESSURE CONTAINER is empty. This indication is used to enable and to disable the GAS MODULES for a flow of fresh gas to vaporizers.



Block diagram: PC 1730 – Inspiratory fresh gas control

Inspiratory fresh gas control

Inspiratory fresh gas control depends on the following settings:

- Volume – When non-rebreathing system is selected.
- Fresh gas flow – When rebreathing system is selected.

The fresh gas flow is also affected by the Instant O_2 Supply (if O_2 FLUSH or EMERGENCY O_2 is activated).

Non-rebreathing mode

The INSPIRATORY FRESH GAS VALVE acts as an inspiratory valve which delivers the total inspiratory gas flow as set on the CONTROL PANEL (Volume).

Rebreathing mode

The INSPIRATORY FRESH GAS VALVE delivers fresh gas flow, as set on the CONTROL PANEL, to be added to the expiratory gas that is used for rebreathing (normally after it has been purified in the CO_2 ABSORBER).

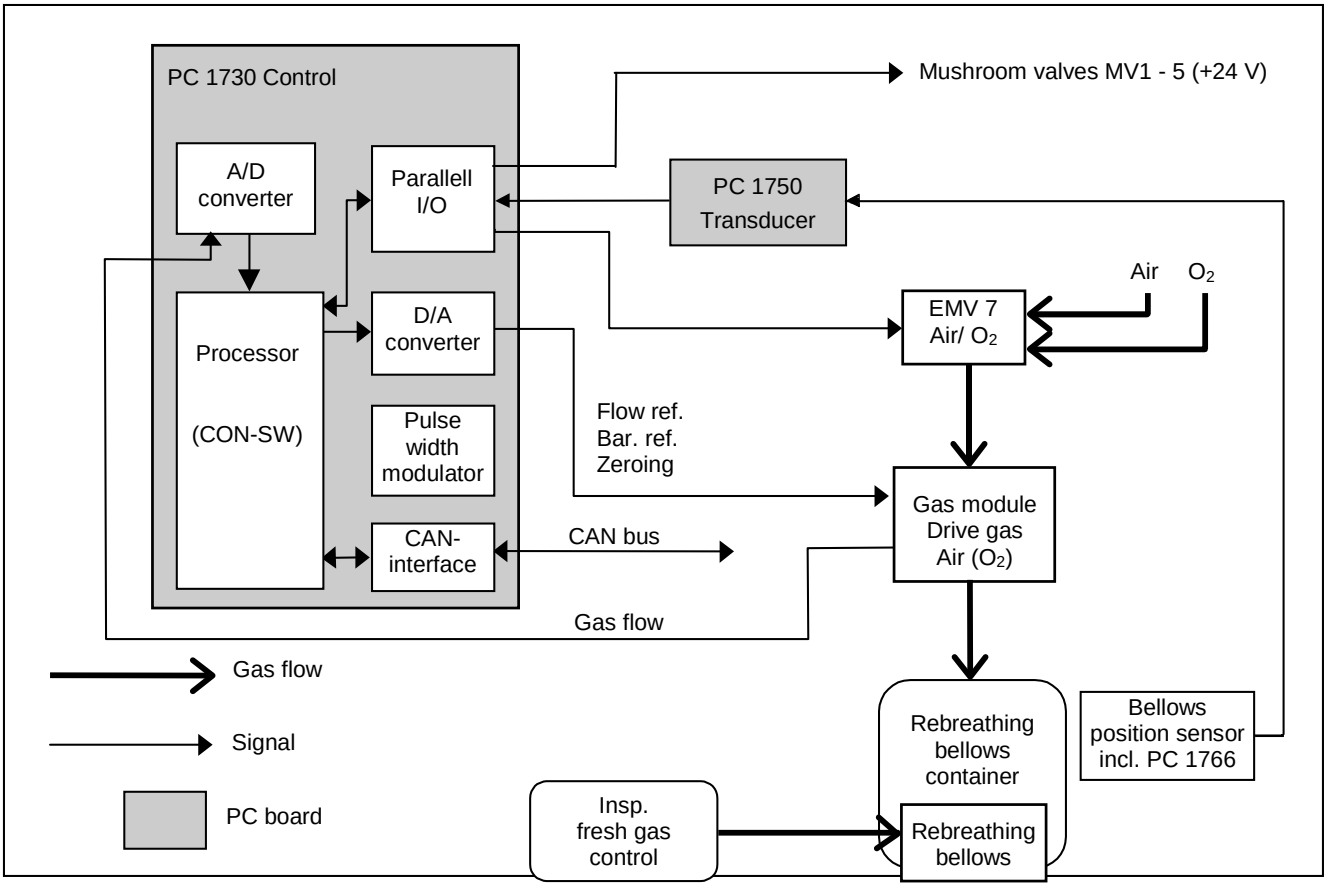
Regulation

A fresh gas flow reference signal (desired value) is distributed via the CAN bus. The CON-SW compares this value with the measured flow (actual value) generated by the fresh gas flow transducer via PC1748 FRESH GAS FLOW. The signal output from PC1748 is a MUX that gives the flow signal 3 different levels of amplification:

- Flow signal x 1
- Flow signal x 50
- Flow signal x 200

A range selection signal is used to select amplification level of flow signal.

As a result of the comparison, control signals (Speed and Direction) are distributed to the INSPIRATORY FRESH GAS VALVE via PC 1751 STEP MOTOR. If the step motor in the fresh gas valve has reached an end position, these control signals are disabled by an end position signal from PC 1751 which prevents it from moving further in the same direction.



Block diagram: PC 1730 – Drive gas for rebreathing

Drive gas for rebreathing

Type of ventilation depends on the following settings:

- Mode of ventilation.
- Breathing system – Circle System/Non-Rebreathing or Auxiliary Fresh Gas Outlet.
- Volume – When rebreathing system is selected.
- Respiratory frequency – CMV (b/min).
- Inspiration time – I:E Ratio.
- Trigger Sensitivity.

Gas module

The GAS MODULE – DRIVE GAS – AIR (O_2) delivers drive gas used to compress the REBREATHING BELLOWS during inspiration time according to the Volume or Pressure level set on the CONTROL PANEL.

The control signals, delivered from the D/A converter on PC 1730 CONTROL to the gas module, are:

- Flow reference (ATP signal).
- Barometric pressure reference.
- Zeroing of flow transducer.

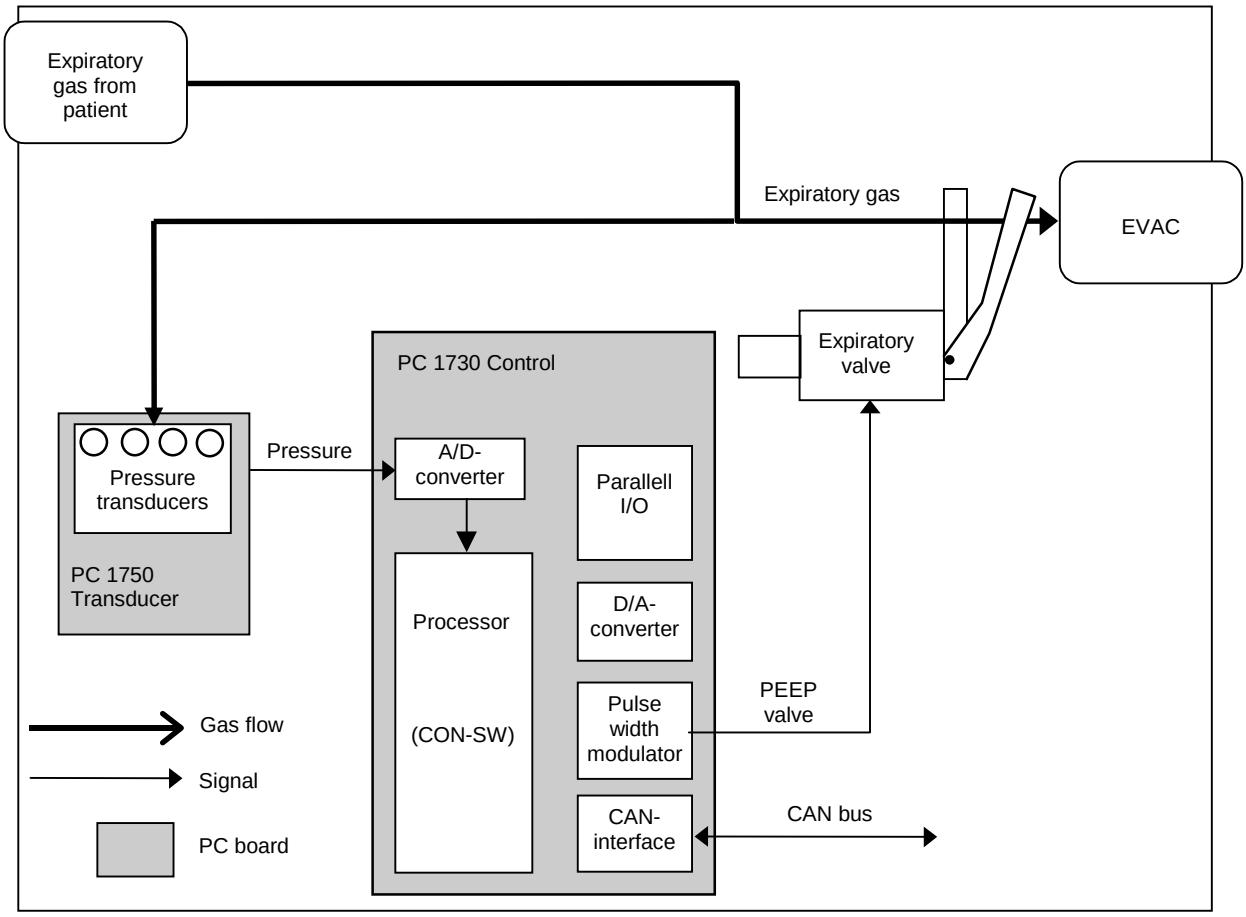
The GAS MODULE creates its gas flow signal which is sent back to PC 1730 CONTROL.

Bellows Position Sensor

Position signal from the optical sensor at the rebreathing bellows container is supplied, via PC1750 TRANSDUCER, to the parallell I/O block. This signal is used to allow outlet of excess expiratory gas from the patient when the REBREATHING BELLOWS is full.

Mushroom Valve Control

The Parallell I/O block supplies signals to activate the electromechanical valves (EMV1 - 5) that control the mushroom valves (MV1 - 5) in the PATIENT CASSETTE.



Block diagram: PC 1730 – Regulation of expiration

Regulation of expiration

Regulation of expiration depends on the following settings:

- PEEP.

The EXPIRATORY VALVE is used to control the expiratory gas from the patient. The sampling point for PEEP pressure is located as close to the EXPIRATORY VALVE as possible to enhance regulation of PEEP.

The PEEP pressure signal from the PRESSURE TRANSDUCER (actual value) is supplied from PC 1750 to the A/D CONVERTER. The CON-SW compares this measured value with the set PEEP value (reference value) from the PEEP setting.

The output signal PEEP valve is supplied to the EXPIRATORY VALVE via the PULSE WIDTH MODULATOR. The control signal is pulse width modulated to prevent effects of hysteresis. The pulse lenght affects the position of the valve; the longer the pulses – the more closed is the valve.

Pressure controlled modes

In pressure controlled modes, the EXPIRATORY VALVE is also used to regulate the inspiratory pressure. This is necessary due to the constant fresh gas flow during inspiration.

The regulation is performed in cooperation with the:

- GAS MODULE FOR DRIVE GAS – When rebreathing system is selected.
- INSPIRATORY FRESH GAS VALVE – When non-rebreathing system is selected.

10. PC 1737 Measuring

Collects, converts and distributes measured patient related values (expiratory flow, O_2 concentration, airway pressure, gas supply pressures). The values are collected and distributed to other unit via the CAN bus.

Detect patient related alarms and informs the ALA subsystem. Alarm limits are either constant values or values set on the control panel.

PC 1737 MEASURING contains a microprocessor that executes the MEA-software stored in the exchangable MEA-PROM.

The main functions are:

- *Expiratory flow measuring*
- *Insp. and Exp. pressure measuring*
- *Gas supply pressure measuring.*

Expiratory flow measuring

The measured expiratory flow value is generated by the EXPIRATORY FLOW TRANSDUCER in the PATIENT CASSETTE. The signal is pre-amplified to a level of 0 – 9 V (9 V = 180 l/min) on PC 1750 TRANSDUCER. The pre-amplified signal Exp. flow is supplied to PC 1737 MEASURING.

To prevent offset in the flow signal, zeroing is done when insp. and exp. time signals are both active.

The exp. flow signal is then amplified in two different levels:

x 0.5 if the exp. flow is 18 – 180 l/min.

x 5 if the exp. flow is 0 – 18 l/min.

Both amplifiers works continuously, but only one of the amplified signal is selected and used by the processor.

Heating of the EXPIRATORY FLOW TRANSDUCER is controlled by PC 1750 TRANSDUCER. A resistor, 220 Ohms / 6W, is moulded into the transducer housing and is used for heating of the flow transducer.
The transducer is heated to approximately 40°C (104°F) to prevent condensation of water vapour.

Insp. and Exp. pressure measuring

PC 1750 TRANSDUCER is equipped with pressure transducers for airway pressures. The signals from the expiratory and the inspiratory pressure transducers are pre-amplified on PC 1750. The amplified signals, Exp. pressure and Insp. pressure, are supplied to PC 1737 MEASURING.

The signals are compared to the set the upper pressure alarm limits and used to activate the upper pressure alarms. There are two different upper pressure alarms, one SW detected and one HW detected:

- SW detection – When the set upper pressure limit is reached, MEA sends a signal to CON in order to start expiration time.
- HW detection – The Upper pressure monitoring blocks activate the pressure alarm and cuts the +24 V power supply to some valves if the set alarm limit is exceeded with 5 cm H_2O. This is a backup function for the SW detection. The following valves are disabled:
  - EMV6 and EMV7
  - All three GAS MODULES
  - INSPIRATORY FRESH GAS VALVE
  - EXPIRATORY VALVE.

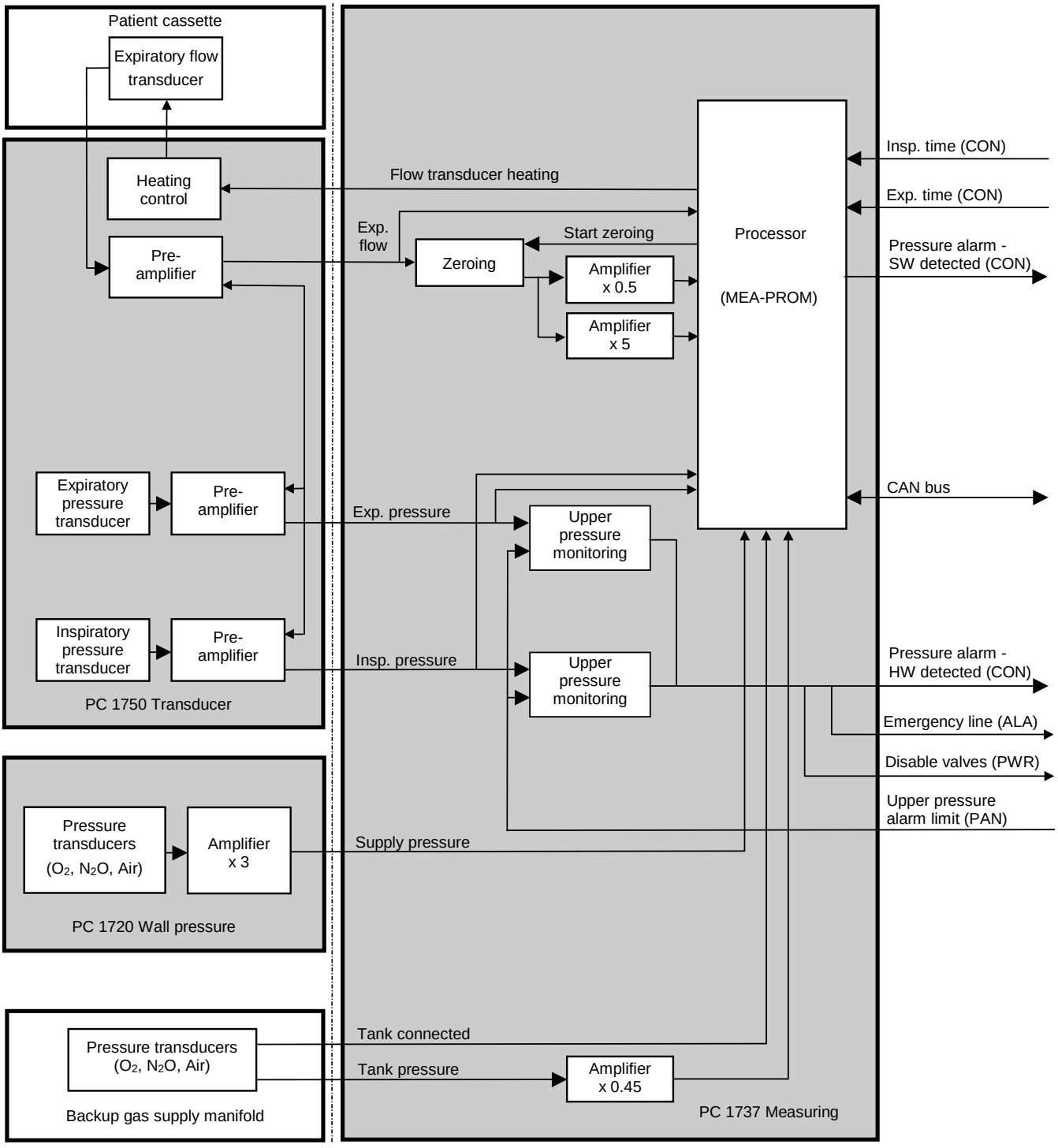
Gas supply pressure measuring

Hospital central gas supply

Pressures in the connected gases are measured by the pressure transducers on PC 1720 WALL PRESSURE. The signals are amplified and supplied to PC 1737 MEASURING. The amplifier on PC 1720 is factory calibrated.

Backup gas supply

Pressure in the connected gas cylinders are measured by the pressure transducers in the BACKUP GAS SUPPLY MANIFOLD. The signal is supplied to PC 1737 MEASURING.



Block diagram: PC 1737 Measuring

11. PC 1750 Transducer

PC 1750 TRANSDUCER contains pressure transducers and pressure amplifiers to measure different gas pressures in the breathing system.

The four pressure transducers mounted on this PC board are connected to the breathing system with internal tubings. The following gas pressures are measured:

- PEEP pressure
- Expiratory pressure
- Inspiratory pressure
- Manual breathing bag pressure.

The amplified signals are supplied, via PC 1733 INTERCONNECTION, to different parts of the KION System.

As the gas in the breathing system may be contaminated, the pressure transducers must be protected with filters. The PEEP pressure transducer filter is mounted on the internal tube and connected onto the transducer. The other three filters are mounted into the silicone muff in the patient cassette docking station. All four filters must be replaced during the "Six months maintenance" and the "Twelve months maintenance".

Vaporizer section

12. Vaporizer magazine

The fresh gas to vaporizers, supplied by the GAS MODULES in the PNEUMATIC SECTION, enters the internal channels in the VAPORIZER MAGAZINE. As long as all vaporizers connected to the VAPORIZER MAGAZINE, are set to OFF, the gas just passes the VAPORIZER MAGAZINE and is routed back to the PNEUMATIC SECTION.

If a vaporizer is active (a concentration is set), the mechanical interlocking system inside the VAPORIZER MAGAZINE routes the fresh gas through the active vaporizer and then back to the PNEUMATIC SECTION.

Three PIVap vaporizers can be mounted onto the VAPORIZER MAGAZINE. The magazine contains three mechanically controlles valves; the VAPORIZER SELECTION VALVES 1 – 3. These valves are activated by the concentration knob on the vaporizer. The mechanical interlocking system makes it impossible for more than one vaporizer to be active at a time.

There are two connection nipples for each vaporizer, one outlet nipple for fresh gas to the vaporizer and one inlet nipple for fresh gas from the vaporizer. There is a one-way valve (OV9 – OV11) in each one of the inlet nipples.

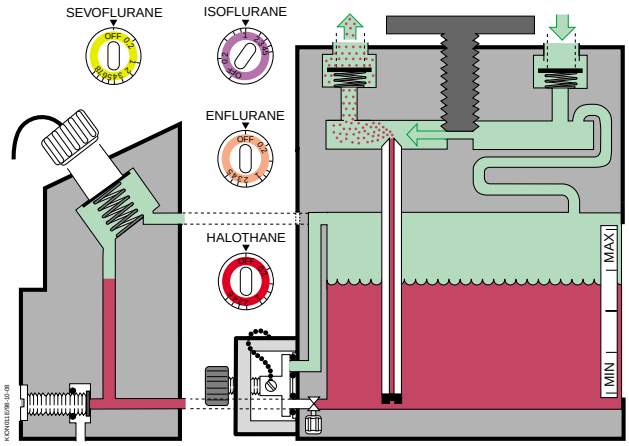
The three one-way valves in the inlet nipples and two O-rings inside the VAPORIZER MAGAZINE must be replaced during the "Twelve months maintenance".

13. PIVap vaporizers

There are PIVap vaporizers available for four different anesthetic agents; Halothane, Enflurane, Isoflurane and Sevoflurane.

A tank inside the vaporizer contains the anesthetic agent. When the fresh gas passes through the vaporizer, the anesthetic agent is injected into the gas. This gas mixture, fresh gas from vaporizer, is then routed back to the PNEUMATIC SECTION.

The PIVap vaporizers are equipped with a key-filling mechanism. For Sevoflurane, there is also a QUIK FIL® version available.



The anesthetic agent concentration delivered by the vaporizer is depending on the ambient temperature and the filling level in the vaporizer. See "Technical specifications" in the "KION – Operating Manual" for further information. The concentration should not be set between Off and the first graduation above zero.

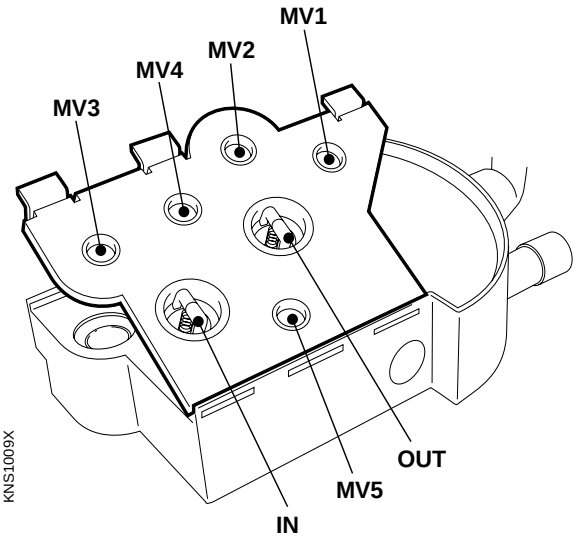
When the vaporizer is activated (a concentration is set with the knob), fresh gas from the GAS MODULES enters the vaporizer. In the vaporizer, the gas passes an adjustable throttle valve. The pressure, built up by the flow resistance in the throttle valve, will act upon the anesthetic agent liquid surface in the reservoir. The liquid will then be pressed through the nozzle into the gas stream after which it vaporizes.

The higher the concentration is set on the knob, the higher the pressure created by the throttle will be. This higher pressure will then force more liquid through the nozzle and a higher anesthetic agent concentration will be the result.

The vaporizers must be checked during the "Six months maintenance" and the "Twelve months maintenance". The two O-rings in each vaporizer valve must be replaced during the "Twelve months maintenance".

Handle the vaporizer with care and never turn a vaporizer containing anesthetic agent upside down or lay it sideways.

2



Patient unit

14. Patient cassette

The PATIENT CASSETTE is a removable and easy-to-clean unit. The five mushroom valves and the two uni-directional valves in the patient cassette control the gas flow in the patient unit.

The gas flow is controlled due to:

- *Selected breathing system.*
- *Selected ventilation mode.*
- *Breath cycle phase.*

The expiratory gas flow is measured by the EXPIRATORY FLOW TRANSDUCER.

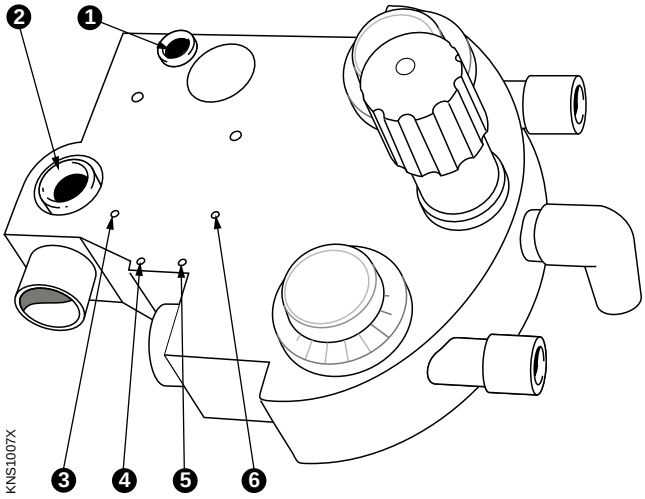
The APL VALVE on the PATIENT CASSETTE is used to limit the airway pressure during manual ventilation.

The PATIENT CASSETTE sub-units are:

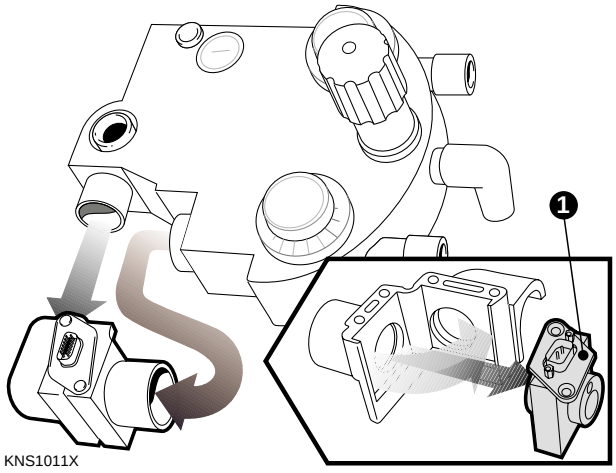
- A removable valve assembly plate with five mushroom valves as indicated in the illustration. The mushroom valves MV1 – 5 controls the gas flow in the PATIENT UNIT. The mushroom valves are controlled by the five solenoid valves EMV1 – 5 on the SUPPORT PLATE FOR PATIENT CASSETTE.
  - MV1 controls the connection to the MANUAL BREATHING BAG.
  - MV2 controls the expiratory flow which is evacuated without being used for rebreathing.
  - MV3 controls the gas flow to and from the REBREATHING BELLOWS.
  - MV4 controls the rebreathing gas flow towards the patient.
  - MV5 controls the fresh gas delivered to the MANUAL BREATHING BAG.

  There are also connections for the CO_2 ABSORBER on the valve assembly plate. The absorber connections (IN and OUT) are equipped with springloaded cut-off valves that will automatically close the connections when the CO_2 ABSORBER is lowered.

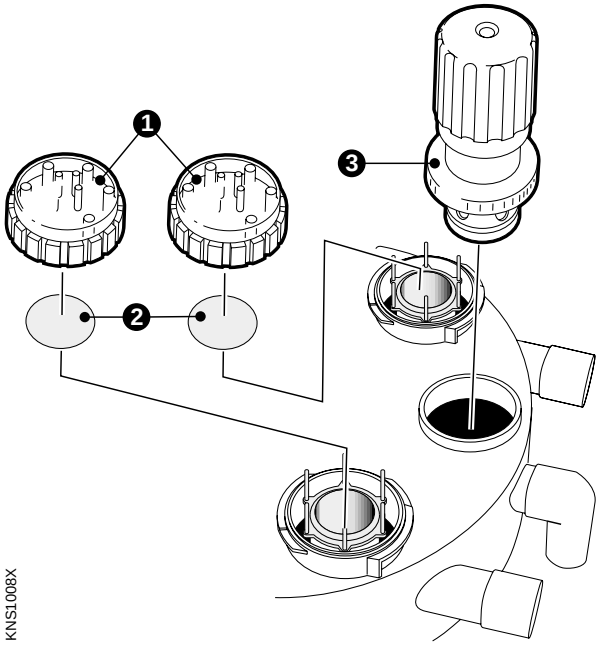
  The valve assembly plate must be replaced during the "Twelve months maintenance".



- The holes on the upper side of the patient cassette are intended for:
  1. Fresh gas to the breathing system.
  2. Inner channel: Expiratory gas to/from the REBREATHING BELLOWS.
     Outer channel: Expiratory gas to the EVAC outlet (via the EXPIRATORY VALVE).
  3. Manual breathing bag pressure.
  4. Sample gas from the MGM.
  5. Expiratory pressure.
  6. Inspiratory pressure.



- EXPIRATORY FLOW TRANSDUCER (1) that measures the expiratory gas flow. The EXPIRATORY FLOW TRANSDUCER is of the same type as the FRESH GAS FLOW TRANSDUCER described in section 6 ”Inspiratory control” in this chapter.
  The expiratory flow transducer screen (mesh net) must be replaced during the ”Six months maintenance” and the ”Twelve months maintenance”.



- Unidirectional valves (2) for the inspiratory and expiratory gas flows. The valve discs are visable inside the transparent plastic covers (1) and the discs are kept in position by guide pins in the valve seat.
- APL, Adjustable Pressure Valve (3), used during manual ventilation to limit the airway pressure. The APL VALVE can be set between SP (Spontaneous breathing = fully open) and 90 cm H_2O. A noticable change in the force required to rotate the knob occurs at approx. 35 cm H_2O.
- Standard connections for patient tubes and the MANUAL BREATHING BAG.

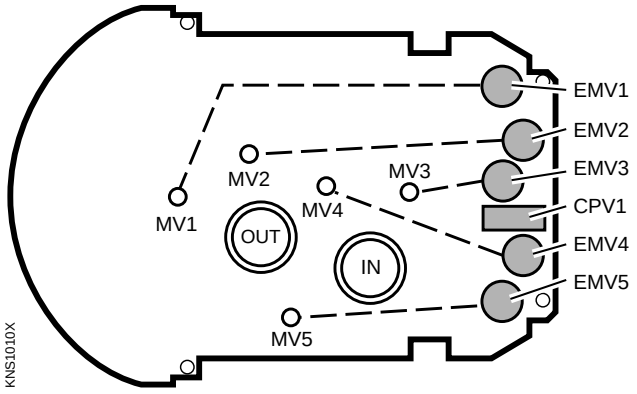
15. Support plate for patient cassette

The mushroom valves in the PATIENT CASSETTE are pneumatically connected to the five support plate solenoid valves via channels in the support plate.

The different channels and the outlet holes in the support plate are showed in the illustration of the support plate below.

When the PATIENT CASSETTE is correctly mounted and secured in the cassette docking station, the five mushroom valves MV1 – 5 in the cassette can be pressurized and depressurized by the electromagnetic valves EMV1 – 5 in the SUPPORT PLATE FOR PATIENT CASSETTE. These valves (EMV1 – 5) are electrically connected to PC 1755 PATIENT CASSETTE VALVE CONTROL.

The CONTROL PRESSURE VALVE CPV1 is a mechanically controlled valve that cuts the gas supply to EMV1 – 5 when the cassette docking station is lowered.



16. Rebreathing section

In rebreathing (Circle System), expiratory gas enters the inside of the REBREATHING BELLOWS during expiration. During inspiration, the bellows will be squezeed and the expiratory gas inside the bellows will be forced through the CO_2 ABSORBER.

The REBREATHING BELLOWS and the bellows container are connected to the breathing system when Circle System is selected on the CONTROL PANEL.

During expiration, expiratory gas from the patient enters the inside of the REBREATHING BELLOWS. During inspiration, drive gas from the GAS MODULE – DRIVE GAS will increase the pressure in the rebreathing bellows container (outside the REBREATHING BELLOWS). The bellows will be squezeed and the expiratory gas inside the bellows will be forced out to (and through) the CO_2 ABSORBER.

17. CO_2 Absorber

In rebreathing (Circle System), expiratory gas is purified in the CO_2 ABSORBER before it is mixed with fresh gas and delivered to the patient.

Expiratory gas from the REBREATHING BELLOWS is routed through the CO_2 ABSORBER and thus purified before it is mixed with fresh gas from the INSPIRATORY GAS BLOCK and delivered to the patient.

The CO_2 ABSORBER is designed to contain 900 ml of absorbent, loose absorbent or pre-packed canisters.

18. Instant O_2 supply

The O_2 FLUSH and the EMERGENCY O_2 can supply extra O_2 into the fresh gas to breathing system. The INSTANT O_2 SUPPLY-functions works without power supply and can thus be used in case of power failure.

O_2 with pressure regulated to 250 kPa by REG2 is delivered from the GAS DISTRIBUTION BLOCK to the INSTANT O_2 SUPPLY-block. INSTANT O_2 SUPPLY contains:

- O_2 FLUSH push-button (marked **O_2+**) for an additional O_2 supply of 35 – 75 l/min @ 2.8 – 6.0 kPa x 100.
- EMERGENCY O_2-selector (marked **5 L/min O_2**) that supplies a continuous O_2 flow of approx. 5 l/min ±10% for manual ventilation in case of ventilator malfunction. A factory preset throttle valve regulates this 5 l/min flow.

When any of these controls are activated, O_2 is routed to the INSPIRATORY GAS BLOCK and connected to the fresh gas to breathing system-channel.

19. Auxiliary fresh gas outlet

An external breathing system, such as Bain, can be supplied with fresh gas from the AUXILIARY FRESH GAS OUTLET.

When the auxiliary fresh gas outlet lever is switched to its horizontal position, fresh gas supply to the PATIENT CASSETTE is cut off. Fresh gas is then supplied through the auxiliary fresh gas outlet.

A Hall sensor detects the position of the auxiliary fresh gas outlet lever. The yellow auxiliary fresh gas outlet LED on the CONTROL PANEL is lit when the outlet is open.

User interface

20. Control panel

Mode selection, fresh gas supply, ventilation parameters and alarms are set on the CONTROL PANEL. The CONTROL PANEL also displays a number of set and measured values.

A description of the control panel functionality can be found in the KION – Operating Manual.

The control panel housing contains the PC 1672 CONTROL PANEL (including all displays) and all potentiometers and switches.

A front panel, available in different language versions, is mounted onto the control panel housing.

PC 1672 CONTROL PANEL contains two exchangable PROMs:

- PAN-PROM with the PAN software.
- ALA-PROM with the ALA software.

The main functions of the software are described in chapter 1. "Introduction" section "Electronic structure".

21. KION Display

The KION Display is a Siemens patient monitor equipped with different levels of functionality. It shows clinical information parameters as configured by the operator.

When integrated with the KION System, the Kion Display will show hemodynamic parameters and:

- Ventilation parameters (curves and loops).
- Airway pressures.
- Fresh gas flow.
- Gas concentrations.
- Supply gas pressure.

The KION Display will also show technical information from the KION System such as alarms and internal battery capacity.

Further, the KION Display is used during the semi-automatic Pre-use Check and Calibration procedures as well as during troubleshooting of the KION System.

For further information regarding the KION Display, see the User's guide and the technical documentation for Siemens Monitors.

Optional equipment

22. Overflow screen

For additional monitoring capabilities, an optional Overflow Screen (DUOVIEW) can be connected to the KION System.

The DUOVIEW is a Surgical Display designed to be an integrated part of the KION System. The DUOVIEW contains the following main parts:

- The Surgical Display Controller. The ISD-SW is stored in a Flash-PROM in the Surgical Display Controller.
- A 10.4 inch color VGA screen.

The DUOVIEW is connected to the KION System with one connector containing 12 V power supply as well as RS232 communication. The DUOVIEW will automatically start when the KION power switch is turned from **Off** to **Standby** or **On**. During the DUOVIEW start-up sequence, communication with KION Display will be established and start-up information will be displayed on the DUOVIEW. The DUOVIEW will be shut off when the KION power switch is set to **Off**. The knob on the DUOVIEW sets the brightness on the screen.

The DUOVIEW is controlled by the KION Display. With the DUOVIEW connected, the information will be displayed as follows:

- Kion Display: A fixed layout containing only ventilation and gas monitoring parameters.
- DUOVIEW: Hemodynamic parameters. Any parameter setting on the DUOVIEW is made on the KION Display as described in the User's Guide for the KION Display.

23. Multi-gas module

An optional MULTI GAS MODULE can be installed into the KION System. The module to be installed is a modified version of the stand-alone Siemens MULTIGAS+™ Module.

A sampling tube is connected to the sampling adapter at the Y-piece. A gas pump in the MULTI GAS MODULE takes a gas samples from the Y-piece. The gas sample is analyzed by the MULTI GAS MODULE and the measured values are shown on the KION Display.

The gas sample is then returned to the expiratory channel in the PATIENT CASSETTE prior to the EXPIRATORY FLOW TRANSDUCER. Thus, the measured expiratory flow includes the gas sample.

If the temperature in the battery drawer compartment is above 45°C (113°F), e. g. due to BATTERY DRAWER FAN failure, the function of the MULTI GAS MODULE may be affected.

For technical information regarding the MULTI GAS MODULE, see the Service Manual for the Siemens MULTIGAS+ Module.

24. Isolation transformer

The purpose of the optional KION ISOLATION TRANSFORMER is to provide the possibility for mains power connection of auxiliary equipment while maintaining the total system earth leakage current below the limits in IEC 60601-1. It provides galvanic isolation from the wall mains outlet.

The ISOLATION TRANSFORMER contains four mains power outlets; 115 V or 230 V, 50 or 60 Hz. Max. outlet is 500 VA and max total leakage current is 100 µA.

A green lamp on the transformer indicates when mains power is available.

The ISOLATION TRANSFORMER is equipped with four fuses:

- Two resetable fuses on the primary side:
  - 6 A on the 115 V transformer.
  - 3 A on the 230 V transformer.
- Two 5x20 mm UL approved fuses on the secondary side:
  - 5 A / 250 V slow-blow on the 115 V transformer.
  - 2.5 A / 250 V slow-blow on the 230 V transformer.

The mains power outlets are designed according to the European standard IEC 320/C14.

Further information can be found in the "KION Isolation Transformer – Operating Manual".

25. Backup gas supply manifold

With the optional KION BACKUP GAS SUPPLY MANIFOLD, backup gas cylinders can be connected to the KION System. The manifold is intended for:

- *N_2O (one gas cylinder)*
- *AIR (one gas cylinder)*
- *O_2 (two gas cylinders)*

The BACKUP GAS SUPPLY MANIFOLD is equipped with PIN-index connections (yokes) for 4 gas cylinders:

- N_2O. One 3-liter gas cylinder. Max cylinder gas pressure is 70 kP x 100 (70 bar) at 35°C (95°F) normally correponding to approx. 50 kPa x 100 (50 bar) at 20°C (68°F) before the pressure regulator.
- AIR. One 3-liter gas cylinder. Max cylinder gas pressure is 200 kP x 100 (200 bar) before the pressure regulator.
- O_2. Two 3-liter gas cylinders. Max cylinder gas pressure is 200 kP x 100 (200 bar) before the pressure regulator.

The gas inlet channels, inside the yokes, contains inlet filters and one-way valves (OV5 – OV7). The filters must be replaced during the "Twelve months maintenance".

The cylinder gas pressure is reduced by the preset pressure regulators (REG5 – REG7). The gas is then connected to the GAS DISTRIBUTION BLOCK via internal tubing.

The integrated pressure transducers are connected to PC 1733 INTERCONNECTION, thus the gas pressure in the cylinders will be displayed on the KION Display. Alarm is activated if the gas pressure is outside the preset alarm limits.

There are three safety valves (SV5 – SV7) on the manifold; one for each gas. The safety valves are preset to open at a pressure of 6.5 kPa X 100 (6.5 bar).

Further information can be found in the "KION Backup Gas Supply Manifold – Operating Manual".

26. Suction equipment

The optional KION SUCTION EQUIPMENT can be mounted on the KION System.

The main parts of the KION SUCTION EQUIPMENT are:

- SUCTION EJECTOR that creates the vacuum. The SUCTION EJECTOR is powered with drive gas (AIR) from the GAS DISTRIBUTION BLOCK. There is an ON/OFF switch and a vacuum control knob on the SUCTION EJECTOR.
- SUCTION BOTTLE. The Siemens 1.8 liter bottle is recommended.

For further information regarding function, operation and technical specifications, see the "KION Suction Ejector – Operating Manual".

27. Auxiliary O_2 supply

The optional KION AUXILIARY O_2 SUPPLY (Auxiliary Oxygen Flowmeter) can be mounted on the KION System. The flowmeter is supplied with O_2 from the GAS DISTRIBUTION BLOCK.

The flow through the AUXILIARY O_2 SUPPLY is set with the flowmeter knob and the actual flow is indicated by the measuring ball inside the measuring channel. The measuring range of the flowmeter is 0 – 15 l/min.

For further information regarding function, operation and technical specifications, see the "KION Auxiliary Oxygen Flowmeter – Operating Manual".

28. Gas evacuation

The optional GAS EVACUATION equipment to be used on the KION System is the Servo Evac 180.

To be mounted onto the KION System, the Servo Evac 180 must be equipped with a bracket and a holder arm. The Servo Evac 180 is connected to the EVAC outlet on the KION System. A Siemens evacuation ejector or the hospital's central vacuum system may be used as an active suction source.

For further information regarding function, operation and technical specifications, see the "Servo Evac 180 – Operating Manual".

Notes

3. Disassembling and assembling

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General

Disassembling and assembling of the main units in the KION System is described in this chapter.

The illustrations in the "KION Spare parts list" (Order No. 63 08 956 E392E) are very useful as a guide when disassembling and assembling the KION System.

Disassembling and assembling of the patient cassette and the CO_2 Absorber is described in the "KION – Operating Manual", chapter "Routine cleaning".

During clinical use of the KION System, it is possible to rotate the user interface arm and the breathing system into a position suitable for the user. It is thus very important to check tubes and cables when assembling the KION System. Make sure that no tubes nor cables are squeezed when rotating the user interface arm and the breathing system.

3

Preparations

Before disassembling or assembling the KION System:

- Set the power switch on the control panel to **Off**.
- Disconnect the mains power cable.
- Disconnect the gas supplies (wall and/or tank).
- Make sure that all gas conveying parts are cleaned according to instructions in the "KION – Operating Manual".

After any service intervention in the KION System, perform a "Function check" and a "Calibration" according to instructions in the "KION – Operating Manual".

Handling PC boards

The PC boards contain components that are highly sensitive to static electricity.

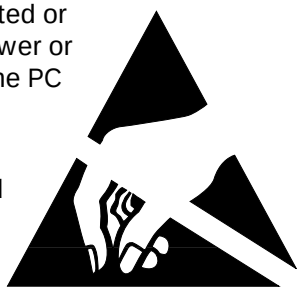
Those who come into contact with circuit boards containing sensitive components must take certain precautions to avoid damaging the components (ESD protection).

When working with ESD sensitive components, always use a grounded wrist band and grounded work surface. Adequate service tools must also be used.

PC boards (spare parts) must always be kept in protective packaging for sensitive electronic device.

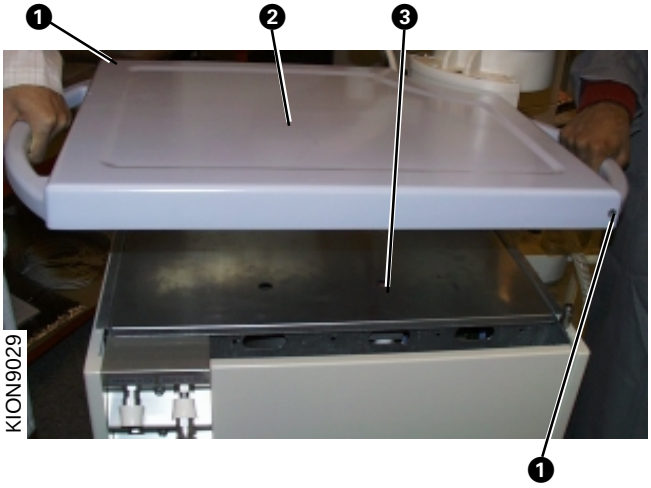
PC boards must not be inserted or removed while the mains power or battery power is applied to the PC boards.

Remove and insert the PC boards very carefully to avoid damage to the connectors.



Covers

Top cover



- Remove the screws (1) holding the top cover.
- Lift off the top cover (2).
- Lift off the shield cover (3).

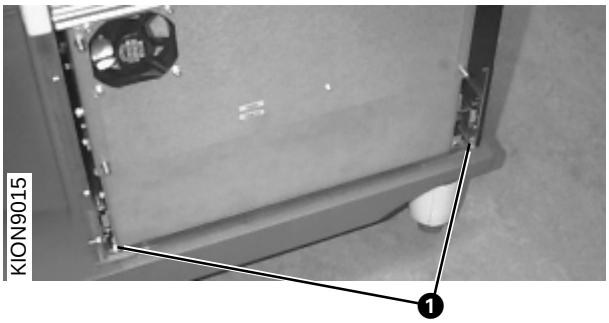
Note: Handle the top cover carefully. The shelf may slide out if the top cover is tilted.

Trolley covers

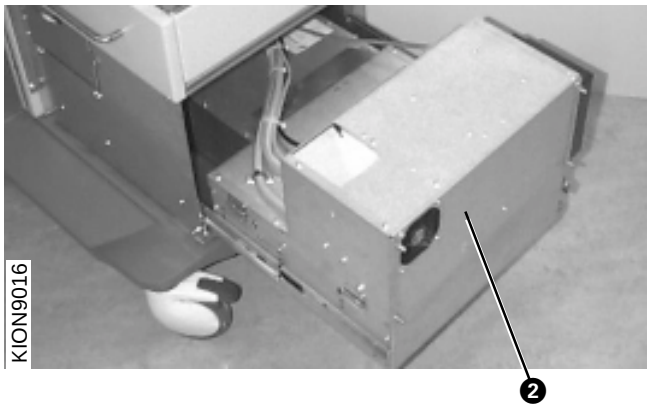
The trolley covers are of a snap-on type. No tools are needed to remove the trolley covers. The photos show some of the trolley covers.

- To remove the trolley covers, pull them straight out.
- To mount the trolley covers, place the cover in position and press it onto the studs.

Battery drawer



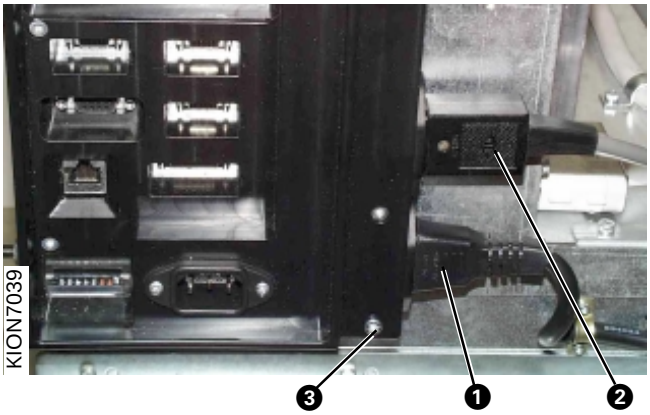
- Disconnect the mains power cable from the inlet connector.
- Remove the screws (1).



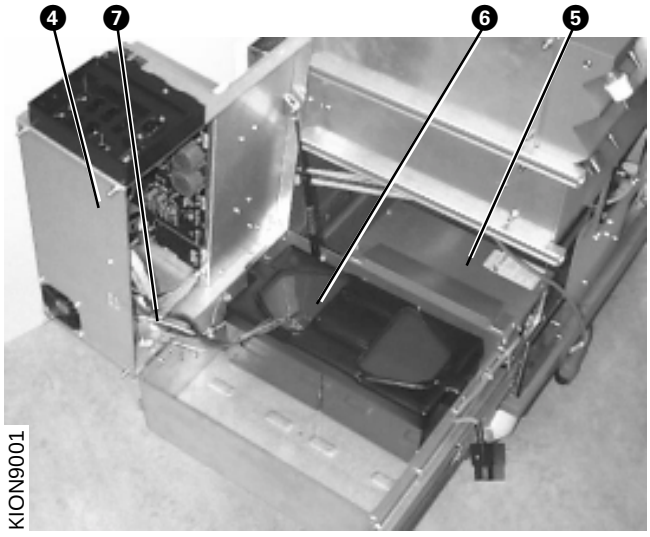
- Pull out the battery drawer (2).

3

Power & Communication interface



- Disconnect the AC/DC Converter cable (1).
- Disconnect the Isolation transformer cable (2) (optional).
- Remove the screw (3).



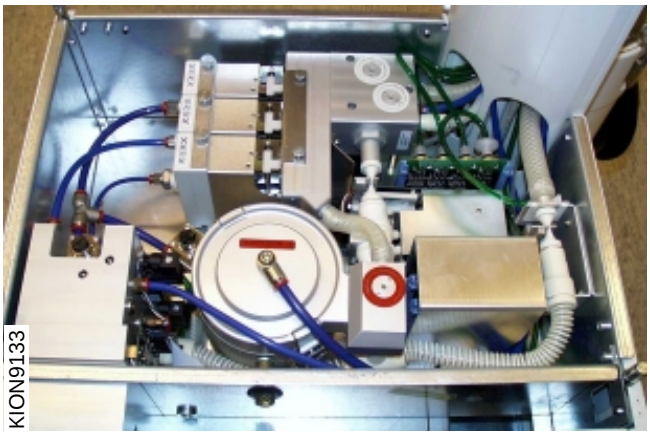
- Open the Power & Communication interface housing (4).

The AC/DC Converter (5), Internal battery (6) and the PC boards inside the Power & Communication interface are now accessible.

> Always disconnect the battery cable (7), when working inside the Power & Communication interface.
>
> Keep fingers away when closing the Power & Communication interface and the Battery drawer!

The assembling procedure is the reverse of the disassembling procedure previously performed.

Pneumatic section


KION9133

All parts inside the pneumatic section are accessible when the top cover and the shield cover is removed.

The KION System in this illustration is equipped with a protective plate covering PC 1730 CONTROL and PC 1737 MEASURING. This protective plate is introduced in KION Systems delivered as from July 1998.
The protective plate must be removed to access PC 1730 CONTROL and PC 1737 MEASURING.

A repeated disconnection/connection of tubes in quick couplings may cause a leakage.

Fresh gas pressure container

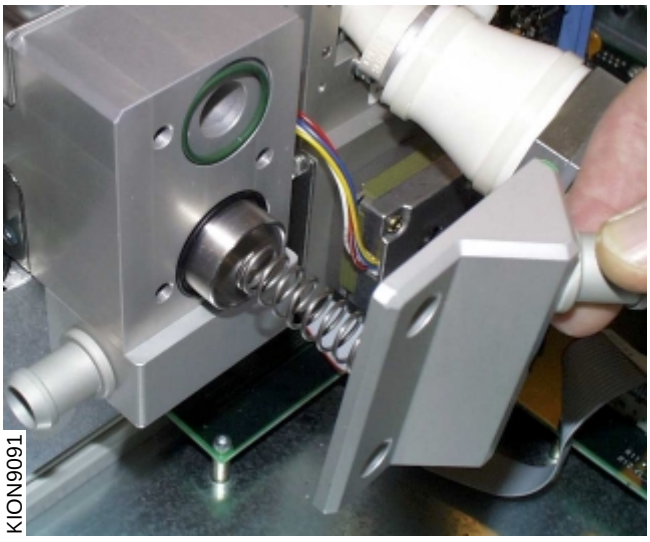
KION9064

If the fresh gas pressure container is to be removed and disassembled, please note the following:

- Before disassembling the fresh gas pressure container, mark (with a pen) the relative positions between the containers:
  - Top cover
  - Intermediate parts
  - Base plate.

  This marking will make a correct assembling easier.
- When assembling the fresh gas pressure container, make sure that the big O-rings between the top cover, intermediate parts and the base plate are correctly seated.

Safety valve SV1

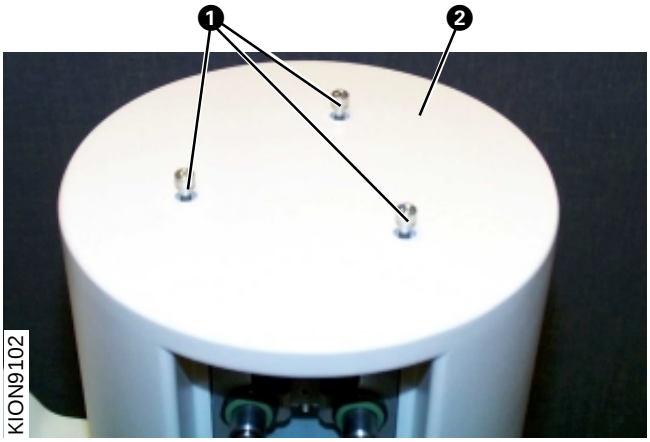

KION9091

The safety valve SV1 is located inside the inspiratory gas block. To access the safety valve:

- Remove the fresh gas pressure container.
- Using a 3 mm insex bit, remove the screws holding the cover and lift off the cover.

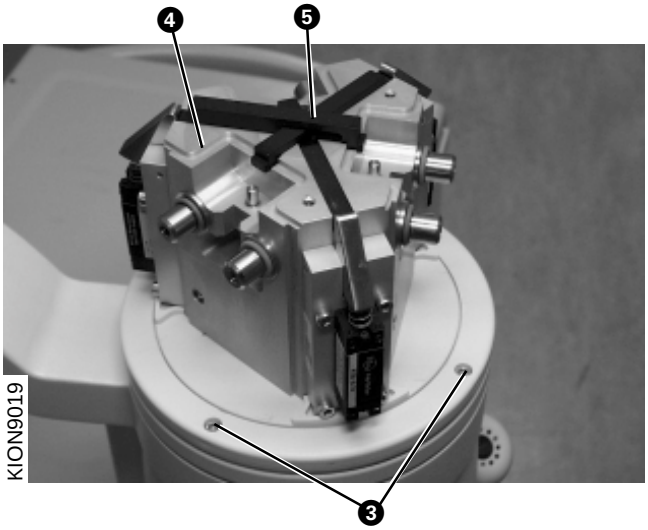
PIVap vaporizers

The PIVap vaporizers must not be disassembled further than showed in chapter 6 ”Maintenance” and in the KION Spare Parts List.



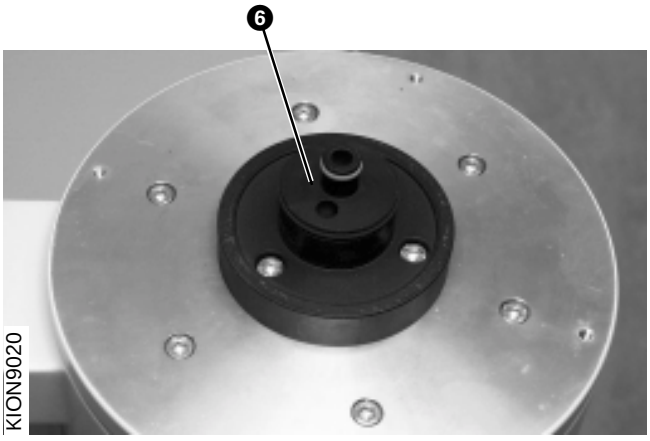
Vaporizer magazine

- Remove the three screws (1).
- Carefully lift off the magazine cover (2).



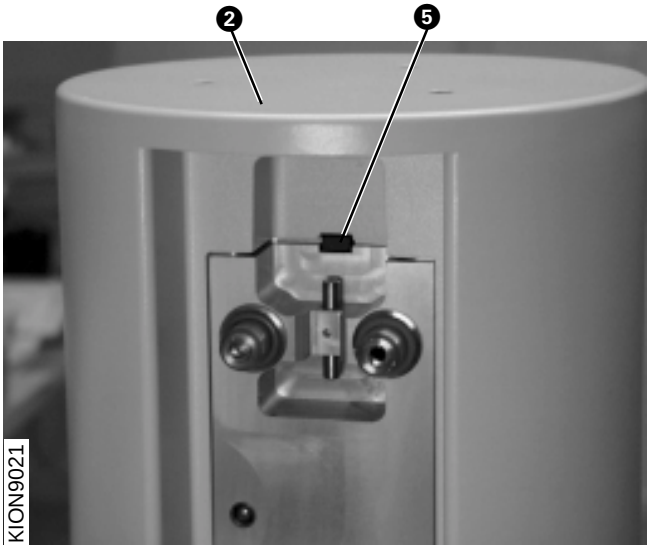
- Remove the four screws (3).
- Carefully lift off the vaporizer magazine (4).

Note: The slide bars (5) are teflon coated and must be handled carefully.



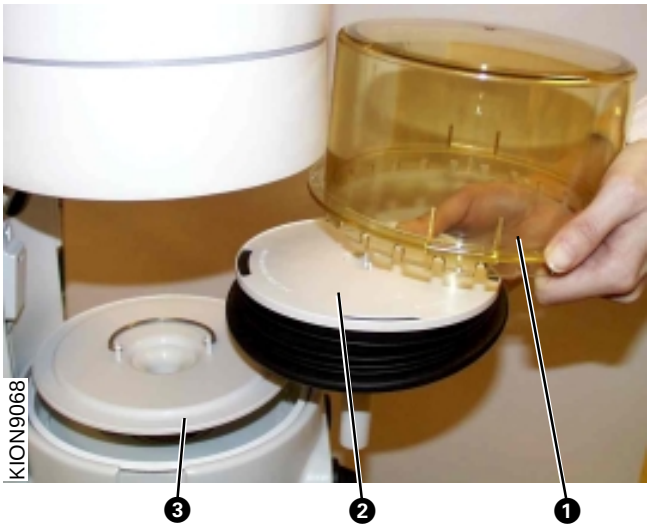
When assembling the vaporizer magazine:

- Place the vaporizer magazine (4) very carefully in position onto the magazine hub (6).

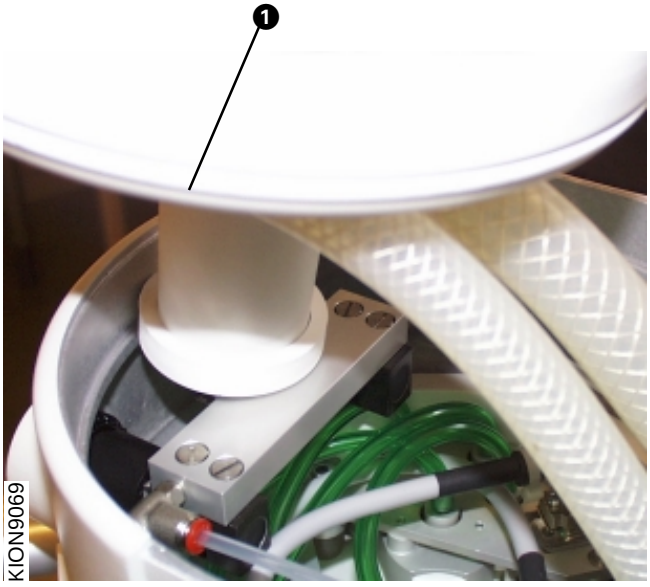


- When mounting the magazine cover (2), make sure that the slide bars (5) fit into the corresponding slots inside the magazine cover.
- When the magazine cover (2) is placed in position on the vaporizer magazine , the three slide bars (5) must be pushed in a few mm to snap into position. If not in position, the cover will ride on the slide bars and the cover cannot be correctly mounted.

Patient unit

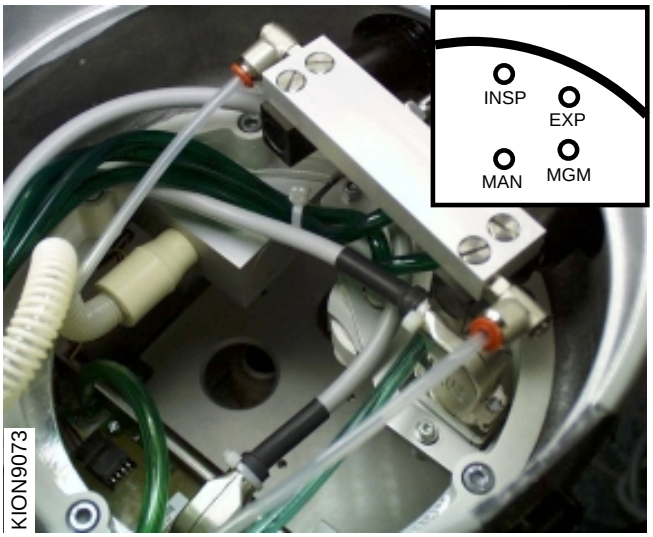


- Unclip and lift off the rebreathing bellows housing (1).
- Lift off the rebreathing bellows (2).
- Lift off the bellows support plate (3).



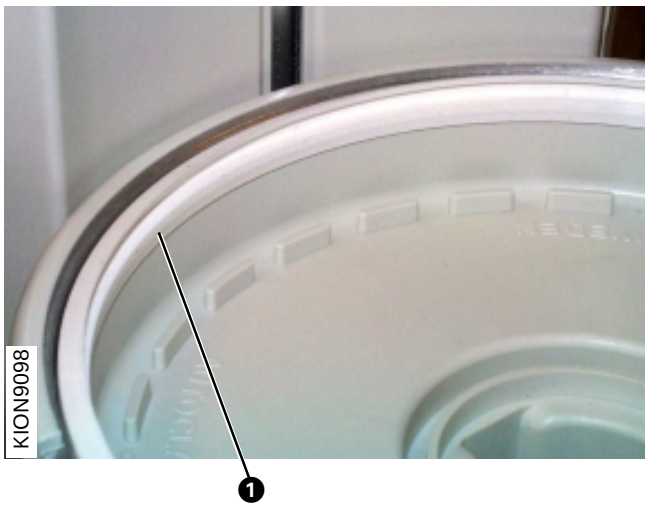
- Remove the bellows base plate (1) including its canister seal and the two connected hoses.
  Note: The two connected hosed (for rebreathing drive gas and for expiratory gas) must be disconnected inside the pneumatic section.

The parts inside the patient unit are now accessible.

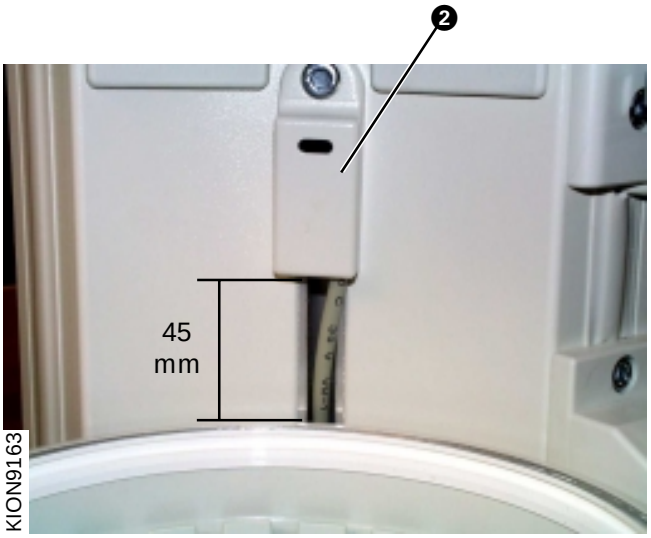


- This illustration shows the position of the tubes and cables inside the patient unit. As it is possible to rotate the breathing system, it is thus very important to check tubes and cables when assembling the patient unit. Make sure that no tubes nor cables are squeezed when rotating breathing system.
- The detail drawing shows the position of the tube nipples for the pressure transducer and MGM tubes.

3

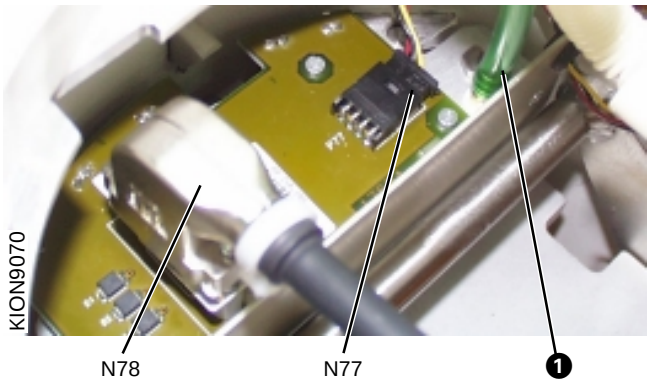


- When mounting the bellows base plate, make sure that the canister seal (1) on the bellows base plate is correctly mounted, see illustration.

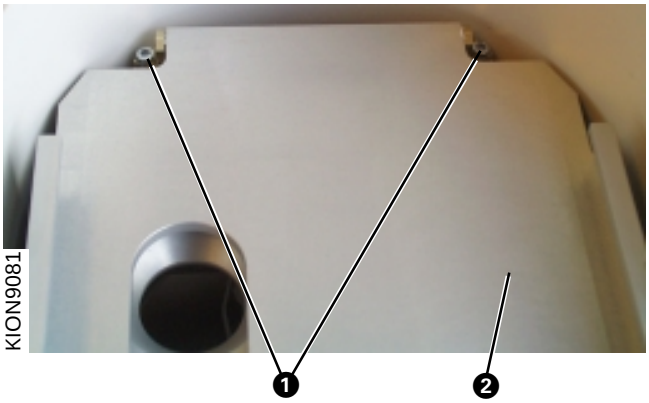


- When mounting the Bellows Position Sensor (2), make sure that the sensor is adjusted into correct position (level) as showed in the illustration.

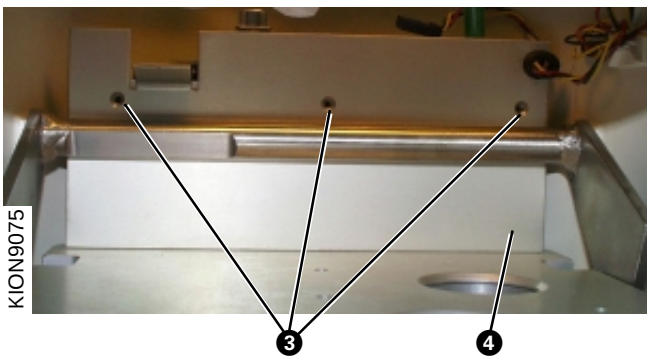
Support plate for patient cassette



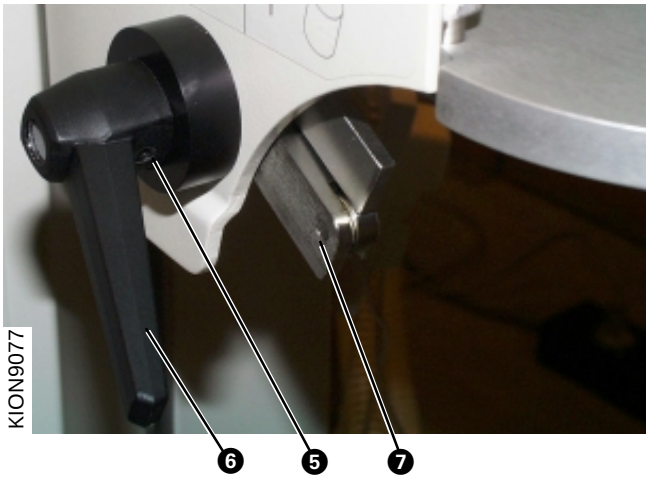
- Remove the bellows base plate as described above.
- Disconnect the mushroom valve control gas supply tube (1). If necessary, cut the tube.
- Disconnect N77 and N78 from PC 1755 PATIENT CASSETTE VALVE CONTROL.



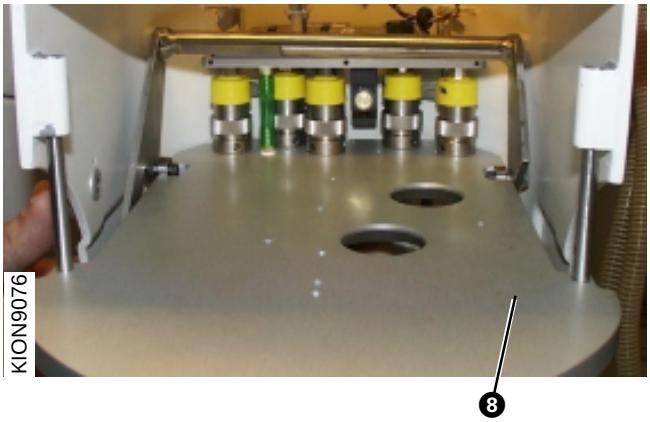
- From underneath the patient unit, remove the screws (1) and lift off the docking plate (2) for the CO_2 Absorber.
  Note: Hold the docking plate when removing the screws. The docking plate will fall down when the screws are removed.



- Remove the screws (3) and lift off the cover plate (4) from the docking station.



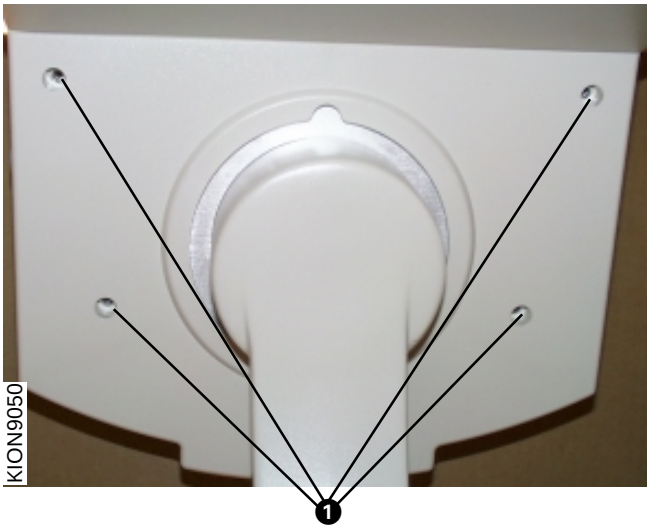
- Loosen the screw (5) and remove the locking lever (6).
- Pull out and lift off the lifter (7).



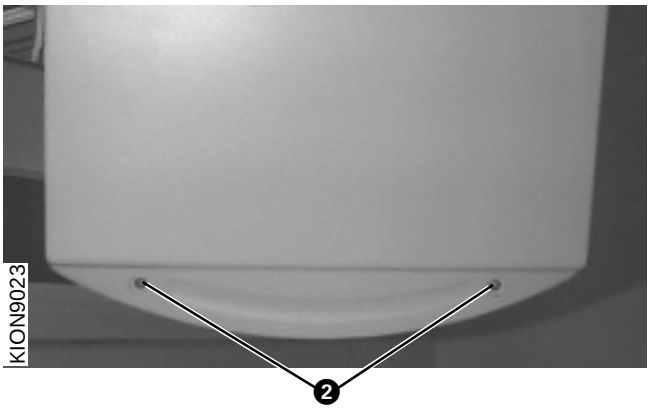
- Carefully pull down the support plate for patient cassette (8) and remove it from the patient unit.

The assembling procedure is the reverse of the disassembling procedure previously performed.

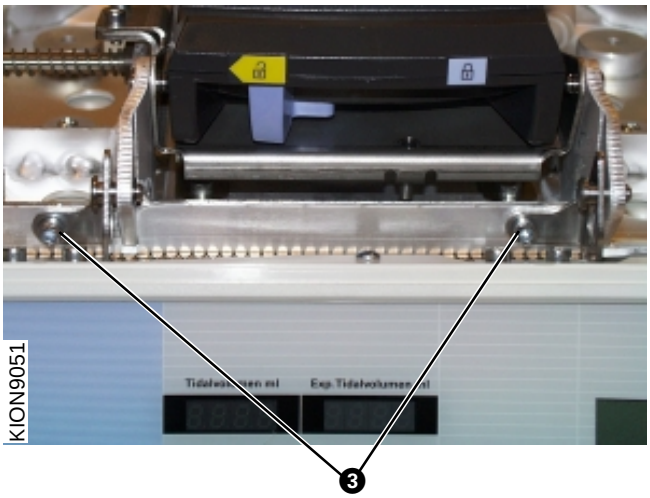
Control panel



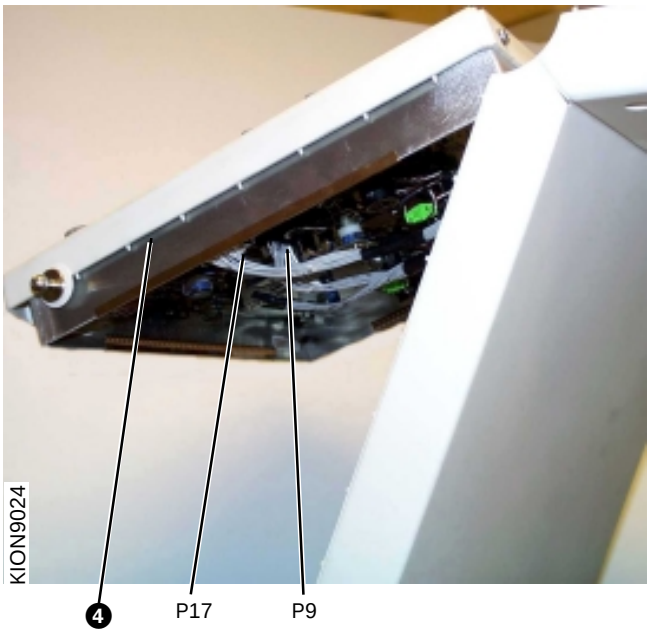
- Remove the KION Display from the docking station.
- Remove the four screws (1) and lift off the upper cover.



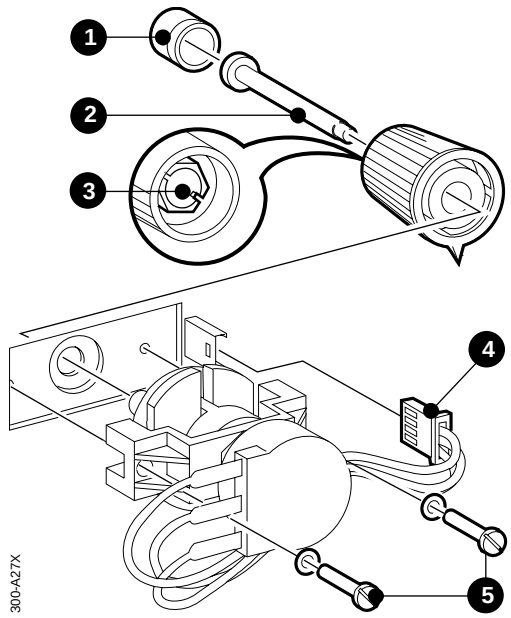
- Remove the two screws (2) on the rear of the control panel.



- Remove the two screws (3).



- Open the control panel housing (4).
- Disconnect the two panel cable connectors from P9 and P17 on the PC 1672 CONTROL PANEL.
- Lift off the control panel housing (4).

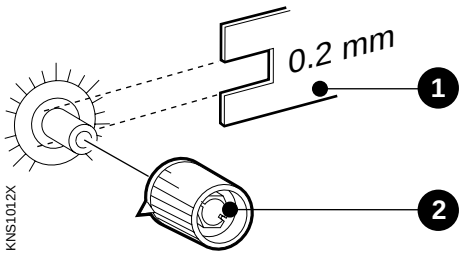


Front panel controls

- Remove the control panel housing as previously described.
- Remove the knob cover (1).
- Remove the pin (2) if the control has a push-button release function.
- Loosen the nut (3) holding the knob and lift off the knob from the control shaft. Use the knob holder tool (Order No. 62 04 197 E380E) when removing and mounting the control knobs.
- Disconnect the connector (4).
- Remove the two screws (5) and lift off the control.

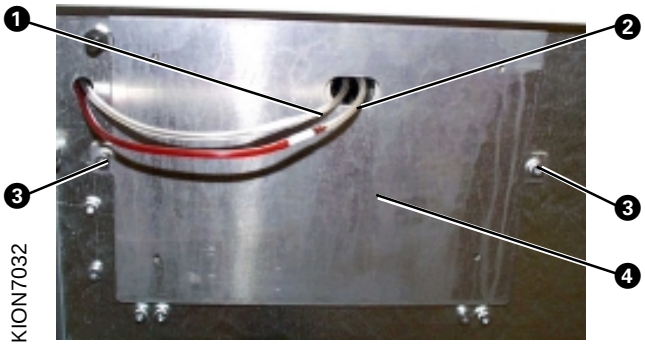
The assembling procedure is the reverse of the disassembling procedure previously performed. The following points must be noted during assembling:

- If the control knob has a pointer, make sure that:
  - On the control panel switches; this knob pointer aligns with the indication lines on the panel in the different switch settings.
  - On the control panel potentiometers; this knob pointer aligns with the end position indications on the panel and, if applicable, with the values showed on the corresponding display.
- Tighten the nut (3) with a torque of approx.:
  - 150 Ncm on the big knobs
  - 90 Ncm on the small knobs.
- If the knob is hard to turn, it can be necessary to put a 0.2 mm thickness gauge (1) between the control panel and the knob while mounting the knob (2).

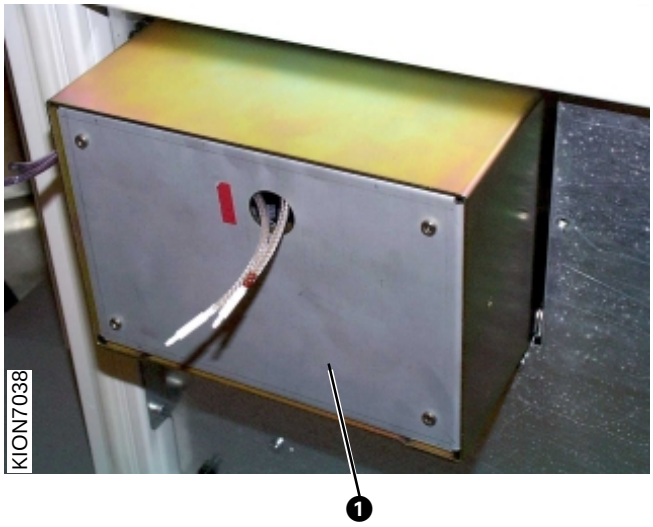


Multi-gas module

- Disconnect the:
  - MGM power cable (1).
  - MGM communication cable (2).
  - MGM sampling outlet tube (3).



- Disconnect the sampling inlet tubes (1 and 2).
  Note – Make sure that the sampling tubes and the corresponding tube nipples are color marked for correct assembling
- Remove the screws (3) and lift off the the cover plate (4).



- Pull out the Multi-gas module (1).

The assembling procedure is the reverse of the disassembling procedure previously performed.

3

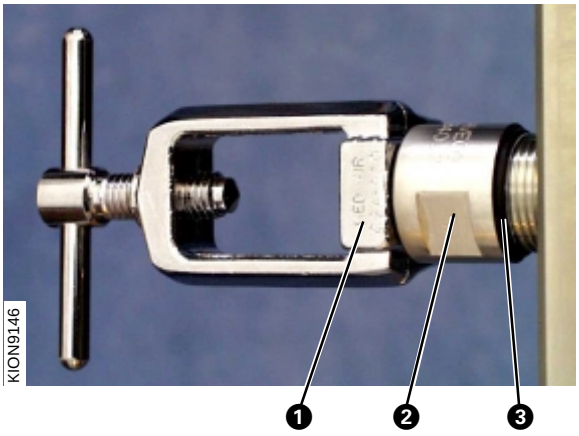
Backup Gas Supply Manifold

Ensure that all gas supplies are shut off and all gas channels are depressurized before any service is performed on the backup gas supply manifold.

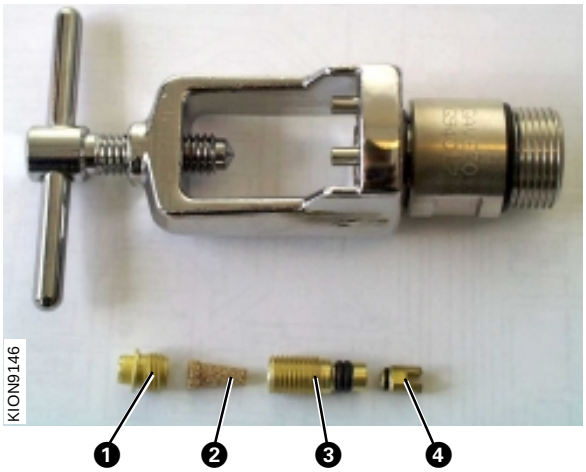
Explosion hazard! The very high pressure O_2-gas connected to the manifold require the use of special O_2-resistant grease, which can be supplied from your local Siemens representative. No other grease must be used!

When assembling the different parts of the manifold, always use new O-rings and gaskets. Apply a thin layer of special grease on the O-rings and gaskets.

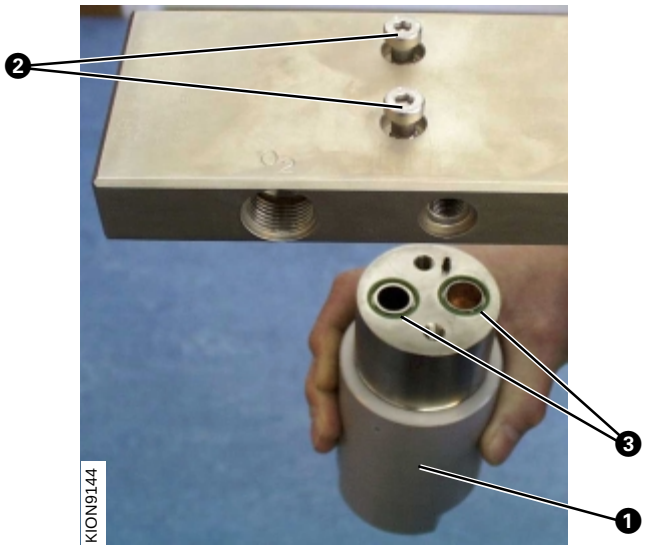
When performing service on the backup gas supply manifold, it is recommended that examination gloves are worn in order to keep all parts clean.



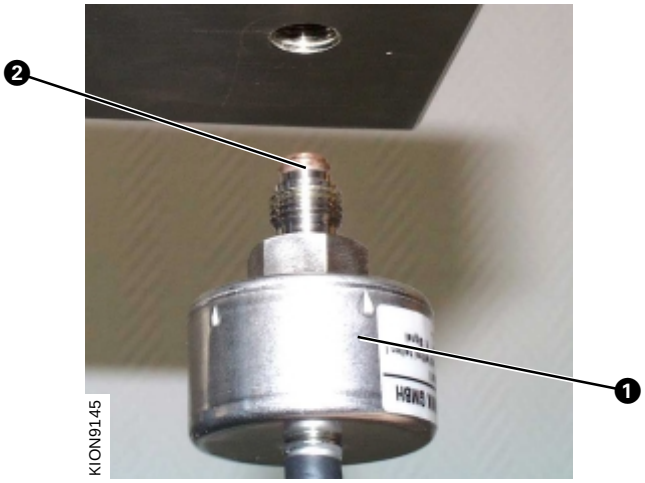
- To remove the yoke (1), unscrew the sleeve (2) using a 22 mm open-end spanner.
- When mounting the yoke, always use a new O-ring (3). Apply a thin layer of special grease on the O-ring. Tightening torque is approx. 50 Nm.



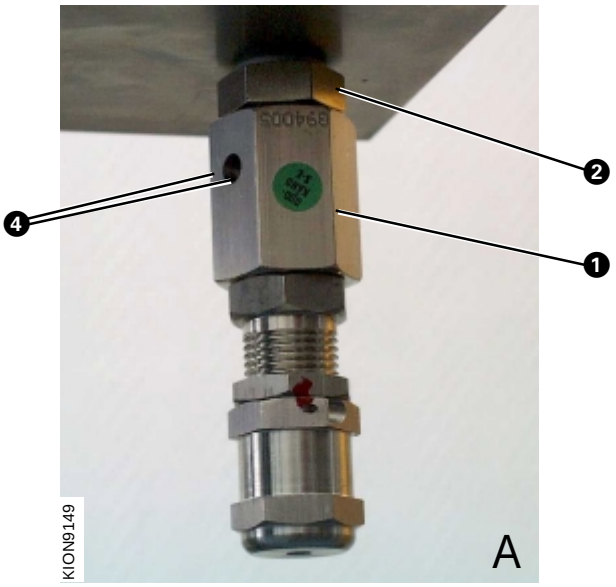
- The gas inlet channel inside the yoke contains the following parts:
  - Filter holder (1). To remove the filter holder, use a 5/32" (4 mm) hexagonal wrench.
  - Filter (2).
  - Valve seat (3) for the one-way valve. To remove the valve seat, use a 3/32" hexagonal wrench.
  - One-way valve (4).
- When assembling these parts, always use new O-rings. Apply a thin layer of special grease on the O-rings.

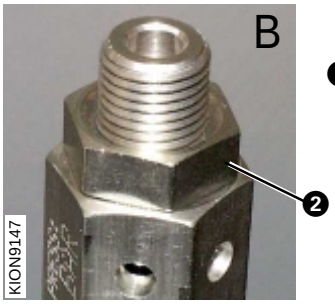


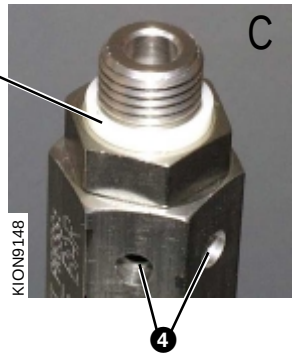
- To remove the pressure regulator (1), unscrew the two screws (2) using a 5 mm hexagonal wrench.
- When mounting the pressure regulator, always use new O-rings (3). Apply a thin layer of special grease on the O-rings. Tightening torque for the screws (2) is approx. 18 Nm.



- To remove the pressure transducer (1), unscrew the transducer using a 19 mm open-end spanner.
- When mounting the pressure transducer, always use a new gasket (2). Apply a thin layer of special grease on the gasket.
- Tighten the pressure transducer by hand. Tighten further approx. half a turn using the open-end spanner.







- To remove the safety valve (1), loosen the nut (2) using a 19 mm open-end spanner and unscrew the safety valve.

- When mounting the safety valve:
  - Screw the nut (2 in Fig. B) as much as possible onto the safety valve. **Note**: There is a groove for the gasket in the nut. This groove must be facing upwards as showed in Fig. B.
  - Place a new gasket (3 in Fig. C) in this groove.
  - Screw the valve (1) as much as possible into the manifold.
  - Unscrew the valve until the two outlet holes (4) are facing away from the operator (downwards/ inwards).
  - Hold the valve in this position and secure it by tightening the nut (2). Tightening torque for the nut is approx. 35 Nm.

4. Service procedures

Pre-use check ..... 4 - 2
Check of gas supply ..... 4 - 2
Leakage automatic ventilation ..... 4 - 2
Leakage manual ventilation ..... 4 - 3
Technical error codes ..... 4 - 3
Checking flow transducers ..... 4 - 4
Checking bellows level detector ..... 4 - 5
Checking alarm detector ..... 4 - 5
Ending the Pre-use check ..... 4 - 5
Calibration ..... 4 - 6
Check of gas supply ..... 4 - 6
Initialization ..... 4 - 6
Pressure transducers ..... 4 - 6
Barometer ..... 4 - 7
Ending the calibration ..... 4 - 7
Software installation ..... 4 - 8

Pre-use Check

The KION System demands the user to start the semi-automatic Pre-use Check at every start-up of the system. It is also possible to access the Pre-use Check via the Kion Display. The KION Display path to select Pre-use Check is:

Main menu / Monitor Setup / Biomed / Service / Calibration / KION Pre-use Check

Note that Service Password is required to access the Service menu.

The Operating Manual describes how to perform this Pre-use Check. The description below gives a more detailed information about the Pre-use Check. This information can be used e. g. during troubleshooting of the KION System.

Check of control panel settings and of gas supply

- The system checks that the Upper Press. Limit knob is set between 60 and 80 cm H_2O.
- The system sets a flow of 0.5 l/min during 1.5 s to be generated by the gas modules AIR (N_2O) – BP and DRIVE GAS for self-adjustment of the flow in these gas modules.
- The gas module AIR (N_2O) - BP generates a flow of 30 l/min.
- The system checks that the AIR supply pressure is above 2.2 bar during 2.5 s.
- The system sets a flow of 0.5 l/min during 1.5 s to be generated by the gas module O_2 – BP for self-adjustment of the flow in this gas module.
- If the AIR supply pressure drops below 2.2 bar during the 2.5 s, the gas module O_2 - BP generates a flow of 30 l/min.
- If O_2 is used, the system checks that the O_2 supply pressure is above 2.2 bar during 2.5 s.

If both AIR supply and O_2 supply fails, the user is requested to connect gases and to restart the Pre-use Check.

Leakage automatic ventilation

Checking the patient unit

The description below refers to Figs. 1 – 3.
The numbering in the description below (1 – 9) refers to the "Time" axis in Figs. 2 and 3.

1. The system generates 5 "flow puffs" to zero the flow transducers in the gas modules.
2. The system generates 5 "pressure puffs" (40 cm H_2O) to stabilize the system and to assure proper function of the seals.
3. The system is emptied during 2 s.
4. The system is pressurized using a flow of 20 l/min. The time to reach to 40 cm H_2O and the filling volume is measured. The system volume is calculated and showed on the control panel.
5. The pressure is cut off at 41 cm H_2O.
6. A 10 s period to stabilize the pressure. If there is a leakage in the system and the pressure drops below 41 cm H_2O during this period, the system will be emptied.
7. A new filling pressure, based on the pressure drop, is calculated and the system is pressurized again to this higher pressure (max 60 cm H_2O).
8. Additional stabilization period ending when the pressure drops below 41 cm H_2O or max 10 s.
9. Measuring period ending after 20 s or when the pressure drops below 39 cm H_2O (leakage). The system calculates leakage flow by measuring pressure difference over a certain time.

   $$\text{Leakage} = \frac{\text{System volume x (P1 - P2)}}{\text{(1013 + Start pressure)}} \times \frac{60}{\text{Meas. period}}$$

   If the pressure drops below 39 cm H_2O during the measuring period, as illustrated in Fig. 3, the test will be interrupted and failed (technical error code 9902 will be displayed).

The measured Start and End pressures are showed on the control panel.

Checking the fresh gas channels

The leakage in the "fresh gas to vaporizer" and "fresh gas from vaporizer" channels will now be checked (gas channels between the gas modules and the one-way valve OV4).

- The system is filled with a volume corresponding to the leakage as calculated above + 200 ml.
- The pressure should now increase. If not, a leakage is detected in these gas channels and technical error code 9909 will be displayed. The leakage (in ml/min) is showed on the control panel and on the KION Display.
- If the leakage is below 150 ml/min, the leakage is accepted and next check will start automatically.
- If the leakage exceeds 150 ml/min, the test will fail and the Pre-use Check will be paused. The user can select **Redo Test** to repeat the check or **Continue** to proceed with next check

Leakage manual ventilation

Checking the patient unit

- All mushroom valves in the patient cassette are opened. In this way, the complete system is checked.
- The test is performed like in automatic ventilation but the max. measuring period is extended from 20 to 50 s. The start pressure is 30 cm H_2O since most manual breathing bags are very elastic and thus 41 cm H_2O can never be reached.
- If the leakage is below 150 ml/min, this leakage is accepted and next check will start automatically.
- If the leakage exceeds 150 ml/min, the test will fail and the Pre-use Check will be paused. The user can select **Redo Test** to repeat the check or **Continue** to proceed with next check

Technical error codes

If the Pre-use Check fails, a technical error code may be shown on the KION Display and on the control panel. A full description of the technical error codes can be found in chapter 5 "Troubleshooting".

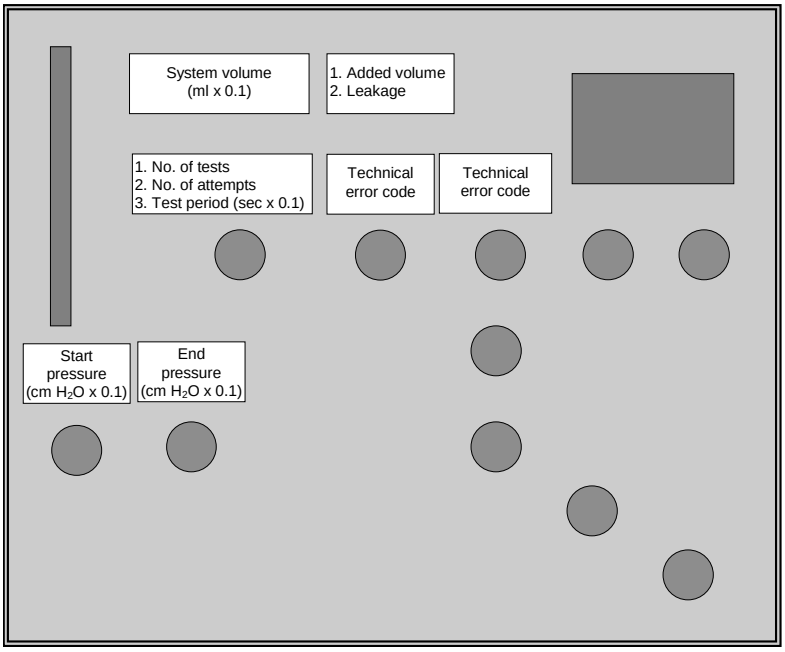


Fig. 1 Values showed on the control panel during the leakage checks

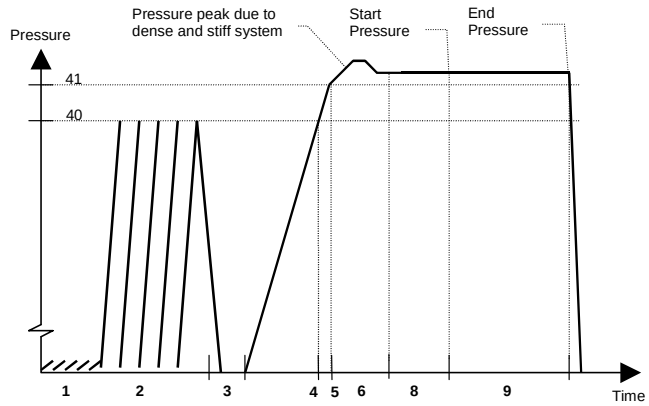


Fig. 2 Pressure diagram – System without leakage

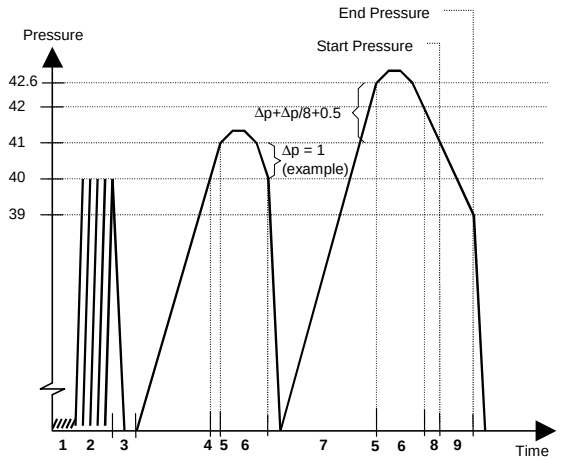


Fig. 3 Pressure diagram – System with leakage, the leakage check will be interrupted

Checking flow transducers

The flow transducer "check" performed in the Pre-use Check is actually a calibration of the fresh gas flow transducer and the expiratory flow transducer.

Fresh gas flow transducer calibration

- The gas supply from the gas modules are cut off and there is no gas flow in the system.
- Offset is adjusted. 50 is showed on Tidal Volume display (green digits).
- Zero is adjusted. This is showed on the Exp. Tidal Volume display (red digits) as a value counting downwards.
- The gas module generates a flow of 9 l/min (1500 ml/s x 0.1) to calibrate the flow transducer gain. Target value is 1560 ml/s x 0.1 ±1%. Adjustment of the E2 pot on PC 1748 FRESH GAS FLOW is made by CON.
- The target flow 1560 ml/s x 0.1 is showed on the Tidal Volume display (green digits). The measured flow is showed on the Exp. Tidal Volume display (red digits).

Expiratory flow transducer calibration

The expiratory flow transducer is located in the patient cassette and the preamplifier on PC1750 TRANSDUCER. Adjustment of the preamplification is performed by MEA.

During calibration, the signals are routed via the CAN bus and the I2C bus.

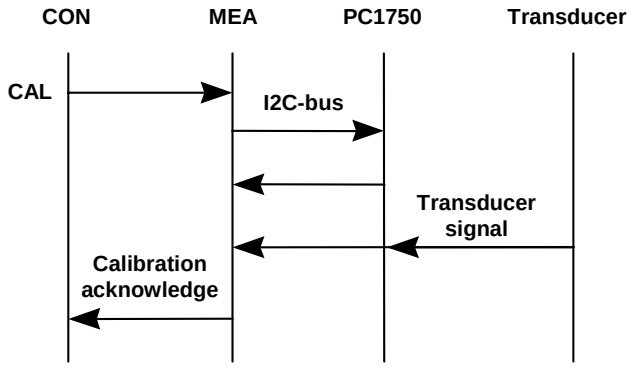


Fig 4. Calibration control

- The gas supply from the gas modules are cut off and there is no gas flow in the system.
- Offset is adjusted in the expiratory flow transducer preamplifier.
- Zero is adjusted. This is showed on the Exp. Tidal Volume display (red digits) as a value counting downwards.
- CON simulates expirations and this is used by MEA to calibrate gain to an Exp. Tidal Volume of 700 ml.
- After a 300 ms delay, the gas module generates a flow of 14 l/min during 3 s (VT_{EXP} = 700 ml)
- CON sends a zeroing command to MEA after each expiration pulse
- During this calibration, the target AD-value is showed on the Tidal Volume display.
- The transducer output value showed on the Exp. Tidal Volume display (red digits). It will be adjusted to the target value. The adjustment is completed when the transducer output value is ±1% of the target value.

The result of the calibrations are showed on the KION Display as **Pass** or **Fail**. Fail means that either or both of the transducer calibrations failed.

Checking bellows level detector

The rebreathing bellows position sensor sensitivity is adjusted via four E2-pots in a cascade coupling on PC 1750 TRANSDUCER. The first one controls values from 0 - 63, the second values between 63 - 126 etc up to 252. 0 is the highest sensitivity.

- CON opens the valves to empty the rebreathing bellows and generates a flow from the drive gas module to squeeze the bellows.
- If the bellows is not emptied within 20 s (due to e.g. a leakage in the rebreathing section) there will be a time out in the test and the Diagnostic Log 232 is generated.

Step 1

- The position sensor is calibrated for the bellows position "empty". Starting with 0 (most sensitive) and stepping upwards until no indication is detected. The adjustment of the E2-pots is showed on the Tidal Volume display (green digits).
- CON initiates a fresh gas flow to fill the bellows.
- If the bellows is not filled within 20 s (due to e.g. a leakage in the rebreathing section) there will be a time out in the test and the Diagnostic Log 232 is generated.

Step 2

- The level detector is calibrated for the bellows position "full". Starting with 0 (most sensitive) and stepping upwards until no indication is detected, the adjustment of the E2-pots is showed on the Tidal Volume display (green digits).

After these two steps, the sensitivity value is adjusted to assure that the bellows position sensor detects the white ring on the bellows.

The sensitivity difference value between the two positions is showed on the Exp. Minute Vol. display (red digits). The result of the adjustment is showed as **Pass** or **Fail** on the KION Display.

Checking alarm detectors

To check the HW pressure alarm detection on MEA the system is pressurized.

- CON opens the valves to empty the rebreathing bellows.
- The gas module generates a constant flow of 3 l/min to pressurize the system. In case of a leakage, this flow will first be increased to 7 l/min and, if necessary, to 15 l/min to assure that the system is pressurized.
- The system checks that the HW pressure alarm is activated at 75 ±5 cm H_2O.

The result of the check is showed as **Pass** or **Fail** on the KION Display.

Ending the Pre-use Check

- The rebreathing bellows is emptied.
- If the Pre-use Check was successful, the counter for "Number of starts without recommended Pre-use Check" will be set to zero. The date will also be saved.
- If the Pre-use Check was interrupted by the operator (by selecting **Cancel** on the KION Display or setting the KION power switch to **On**) or if any of the checks failed, the old values in the E2-PROMs will be restored.
- The valves are set in position for Manual Ventilation.

Calibration

The Operating Manual describes how to perform the semi-automatic Calibration. The KION Display path to select Calibration is:

Main menu / Monitor Setup / Biomed / Service / Calibration / KION Calibration

Note that Service Password is required to access the Service menu.

The description below gives a more detailed information about the Calibration. This information can be used e. g. during troubleshooting of the KION System.

Check of gas supply

- The system sets a flow of 0.5 l/min during 1.5 s to be generated by the gas modules AIR (N_2O) – BP and DRIVE GAS for self-adjustment of the flow in these gas modules.
- The gas module AIR (N_2O) - BP generates a flow of 30 l/min.
- The system checks that the AIR supply pressure is above 2.2 bar during 2.5 s.
- The system sets a flow of 0.5 l/min during 1.5 s to be generated by the gas module O_2 – BP for self-adjustment of the flow in this gas module.
- If the AIR supply pressure drops below 2.2 bar during the 2.5 s, the gas module O_2 - BP generates a flow of 30 l/min.
- If O_2 is used, the system checks that the O_2 supply pressure is above 2.2 bar during 2.5 s.
- If both AIR supply and O_2 supply fails, Calibration is ended and "Calibration Complete" is showed on the KION Display.

Initialization

- Calibration instructions are showed on the KION Display.
- CON sets the gas mixture to O_2/Air.
- The valves are set for Manual Ventilation and Rebreathing to depressurize the system.

Pressure transducers

During calibration, the pressure transducers are identified as follows on the KION Display:

1 = Exp. pressure transducer

2 = Insp. pressure transducer

3 = PEEP pressure transducer

4 = Manual pressure transducer

Calibration sequence

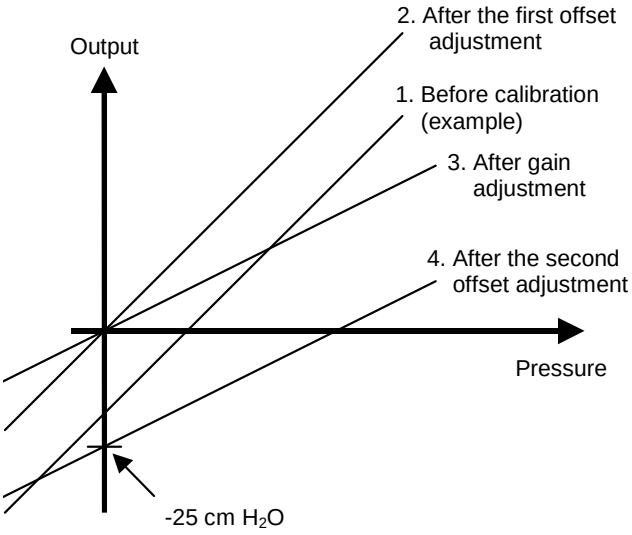


Fig. 5 Calibration sequence

PEEP, Exp. and Insp. pressure transducers

Bold numbers within brackets in the text below refers to the diagram in Fig. 5.

- CON adjusts the PEEP pressure transducer offset to 0. This is showed on the Exp. Tidal Volume display (red digits). (**2**)
- CON sends a message to MEA to adjust Exp. pressure transducer offset to 0. This is showed on the Exp. Tidal Volume display (red digits). (**2**)
- CON sends a message to MEA to adjust Insp. pressure transducer offset to 0. This is showed on the Exp Tidal Volume display (red digits). (**2**)
- The expiratory valve is closed to enable the system to be pressurized.
- The operator is demanded to set a flow using the Fresh Gas Flow setting knob and to enter the pressure value read on the calibration manometer using the Preset O_2 Conc. setting knob.
  The value showed on the Fresh Gas Flow display is proportional to the flow generated by the gas module, approx. 0 – 992 ml/min.
- Pressure transducer gain for the three transducers are adjusted against the value entered on the control panel. This is showed on the Exp. Tidal Volume display (red digits). The value is corresponding to the pressure value set on the control panel. (**3**)
  - CON calibrates the PEEP pressure transducer.
  - MEA calibrates the Exp. pressure transducer.
  - MEA calibrates the Insp. pressure transducer.
- The system is depressurized.
- The offset adjustments of the pressure transducers are repeated but with a negative offset (-25 cm H_2O) to enable measurement of negative pressures.
  This is showed on the Exp. Tidal Volume display (red digits). The value is corresponding to the offset value 2500 (cm H_2O x 100) for PEEP and 170 (AD value) for Exp. / Insp. (**4**)

The results of the calibration of pressure transducers 1, 2 and 3 is showed on the KION Display with the number of the transducer followed by **Pass** or **Fail**.

Manual pressure transducer

Bold numbers within brackets in the text below refers to the diagram in Fig. 5.

- The system is depressurized and the offset adjustment starts.
- CON adjusts the Manual pressure transducer offset to 0. This is showed on the Exp. Tidal Volume display (red digits). (**2**)
- The expiratory valve is closed to enable the system to be pressurized.
- The system is pressurized with a constant pressure and the manual breathing bag is inflated.
- The Manual pressure transducer gain is calibrated against this constant pressure. This is showed on the Exp. Tidal Volume display (red digits). The value (cm H_2O x 100) is corresponding to the constant pressure value set by the system. (**3**)
- The system is depressurized.
- The offset adjustment of the pressure transducer is repeated but with a negative offset (-25 cm H_2O) to enable measurement of negative pressures.
  This is showed on the Exp Tidal Volume display (red digits). The value is corresponding to the offset value 2500 (cm H_2O x 100). (**4**)

The results of the pressure transducer 4 calibration is showed on the KION Display (**Pass** or **Fail**).

Barometer

The barometric pressure value is used by the KION System to increase the accuracy of the of gas supply regulation in the gas modules.

- The actual measured barometric pressure is showed on the Tidal Volume display. The operator is demanded to adjust this value (if necessary) using the Fresh Gas Flow knob to enter a new value.

The result of the barometer calibration is showed on the KION Display (**Pass** or **Fail**).

Ending the Calibration

If the Calibration was interrupted by the operator (by selecting **Cancel** on the KION Display or setting the KION power switch to **On**) or if any of the Calibrations failed, the old values in the E2-PROMs will be restored.

Software installation

There are a number of different softwares included in the KION System. Perform as follows when updating these softwares:

CON-SW

The CON-software (CON-SW) is stored in a FLASH-PROM on PC 1730 CONTROL. To update the CON-SW, replace PC 1730 CONTROL.

MEA-PROM

The MEA-software is stored in an exchangable program memory (MEA-PROM) on PC 1737 MEASURING. To update the MEA-software, replace the MEA-PROM.

ALA-PROM

The ALA-software is stored in an exchangable program memory (ALA-PROM) on PC 1672 CONTROL PANEL. To update the ALA-software, replace the ALA-PROM.

PAN-PROM

The PAN-software is stored in an exchangable program memory (PAN-PROM) on PC 1672 CONTROL PANEL. To update the PAN-software, replace the PAN-PROM.

MGI-PROM

The MGI-software is stored in an exchangable program memory (MGI-PROM) on PC 1747 CAN/ RS232 INTERFACE. To update the MGI-software, replace the MGI-PROM.

KION DISPLAY-SW

The KION DISPLAY-software is stored in the KION Display. New software can be installed from a PC Card using the card reader on the KION Display.

Perform the software installation as described in the instructions delivered with the PC Card.

CPS-SW

The CPS-software is stored in the COMMUNICATION INTERFACE (CPC Network PCB). New software can be installed from a PC Card using the card reader on the KION Display.

Perform the software installation as described in the instructions delivered with the PC Card.

Configuring the CPS

When delivered, the KION System is configured as a stand-alone unit. A configuration of the CPS network functions is necessary to perform e. g.:

- When the KION System will be connected to an INFINITY network.
- When installing a new CPS Network PCB into a KION System (stand-alone as well as network connected). The default configuration will not work correctly together with the KION Display. A “No Screen” alarm will be activated on the KION control panel and the messages “CPS/IDS Access failed” and “OFFLINE” will be showed on the KION Display. Furthermore, there will be no access to the CPS functions in the KION Display service menu.

A complete description of a CPS configuration for INFINITY Network can be found in the ”INFINITY Network – Planning, design and installation handbook”.

The brief description below shows the main steps of a stand-alone configuration.

A PC with the software HyperTerminal (included in Windows) can be used.

- Make sure that the PC and the KION System is turned **Off**.
- Connect an RS232 cable (Order No. 47 14 346 E530U to a **COM** port on the PC. Connect the other end of the cable to the **X4** port on the KION System.
- Turn the PC **On** and the KION System to **Standby**.
- Start the terminal program and make the following COM port-settings:
  Bits per second: 19200
  Data bits: 8
  Parity: None
  Stop bits: 1
  Flow control: None

- Press Enter to access the “System console menu”. Make sure that the main menu “CPS 68030 SYSTEM CONSOLE” is displayed.
- Select ”11” – Display/Modify NW Config Data
- Select ”3” – Input all NW Config data
- Press ”Enter” on all suggested settings (to accept default settings) with the following exeptions:
  - Bed label: Type e.g.”BED”
  - CPS label: Type e.g. ”OP1”
  - Care Unit label: Type e.g. ”OP”
  - Monitoring unit label: Type e.g. ”MON1”
  - Hospital label: Type e.g. ”Central”.

It is not necessary but recommended to enter ”Recorder” names. This makes it possible to connect a recorder at any time. Type e.g. ”Rec 1”as name of the primary recorder as well as the secondary recorder

- Turn the PC and the KION System **Off**.
- Disconnect the RS232 cable between the PC and the KION System.
- Restart the KION System. The new CPS configuration will now be used.

Display CPS configuration

With a PC connected (as previously described) it is also possible to display the CPS configuration.

- Access the “System console menu”. Make sure that the “CPS 68030 SYSTEM CONSOLE” is displayed.
- Select ”11” – Display/Modify NW Config Data
- Select ”0” – Display NW Config

The example below shows Network Configuration data for a KION System configured as a stand-alone unit:

CPS Host ID: 0

Monitoring unit ID: 1

IP Addr: 191.1.1.0

Subnet Mask: 255.255.0.0

Default Route: 0.0.0.0

Bed Label: BED1

Recorder 1 Label: REC1

Recorder 2 Label:

CPS Label: OP1

Monitoring Unit Label: M1

Care Unit Label: OP

Hospital Label: HOSP

Primary Recorder: REC1

Secondary Recorder: REC1

Primary Alarm Recorder: REC1

Secondary Alarm Recorder: REC1

Remote Silence Enabled: Yes

Remote Control Enabled: Yes

Alarm Group: 0

Will this bedside be monitored by a Central Station?: Yes

Network Mode: Standalone

Recorder Use: Global

Laser Printer IP Addr: 191.1.1.240

ISD-SW

The ISD-software is stored in the Surgeon Display Controller (SDC) inside the DUOVIEW.

A PC and a download cable, Art. No. 55 96 502 E537U, must be used when installing the ISD-software. The rear cover of the DUOVIEW must be removed to access the SDC connectors.

A complete description of the software installation can be found in the "Surgeon Display Controller – Software Installation Instructions" delivered with the ISD-software.

Note: The DUOVIEW is power supplied by the KION System. Thus, the KION System must be switched to **Standby** (or **On**) during the software installation.

MGM-SW

The MGM-software is stored in two exchangable program memories on the MGM SYSTEM BOARD inside the Multi-gas Module. To update the MGM-software, replace the:

- AMA-PROM (Agent Measurement Analyzer) and/or
- AIDA-PROM (Agent Identification Analyzer).

5. Troubleshooting

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5

General

Before starting troubleshooting, try to eliminate all possibilities of operational errors. If the malfunction remains, use the troubleshooting guides below as well as the information in chapter "2. Description of functions" to locate the faulty part. Perform actions step by step and check that the malfunction is eliminated.

When the fault is corrected, carry out a complete "Function check" as described in the Operating Manual.

The troubleshooting guides below are focused only on technical problems. Information about clinical related alarms can be found in the Operating Manual.

During the "Pre-use check", the result of the check is showed on the KION Display, i. e. if the check was *OK* or if it *Failed*. However, important technical information, useful when troubleshooting the system, is also showed in the digital displays on the control panel. For further information about the "Pre-use check" and the information showed on the control panel, see chapter "4. Service procedures".

5

Possible causes to malfunction not mentioned in the following troubleshooting guides are:

- The system has not been correctly assembled after cleaning, maintenance or service.
- Disconnection or bad connection in cable connectors, PC board connectors, and inter-connection boards.
- Disconnected or defective gas tubes, breathing gas as well as drive gas. **Note**: Repeated disconnection/connection of tubes in quick couplings may cause a leakage.

These possible causes to malfunction must always be concidered during troubleshooting.

This chapter is divided into four sections:

Technical error codes showed during the "Pre-use check"

The "Pre-use check" includes two leakage tests (Leakage automatic ventilation and Leakage manual ventilation). This section describes possible causes and recommended actions if a technical error code is showed after these leakage tests.

If the "Pre-use check" fails

This section describes possible causes and recommended actions if any of the tests included in the "Pre-use check" fails.

Other technical errors

This section describes possible causes and recommended actions in case of other technical errors in the KION System.

Technical alarms and Diagnostic logs

This section describes the Technical alarms and the Diagnostic logs that are stored in the KION Display and in the Communication interface (CPS). These logs can be used during troubleshooting of the KION System.

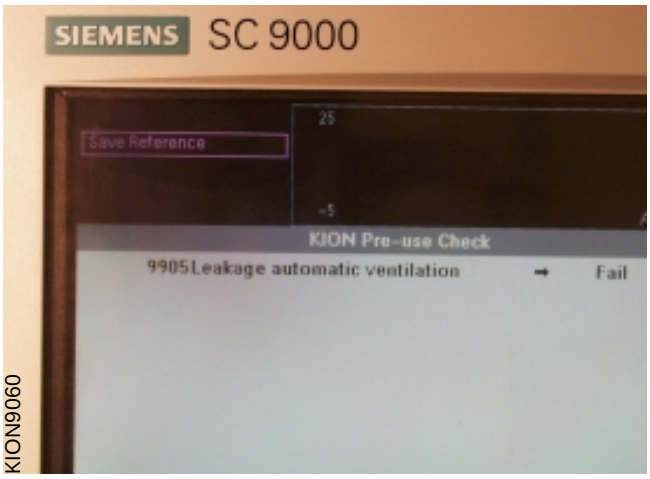
Required equipment

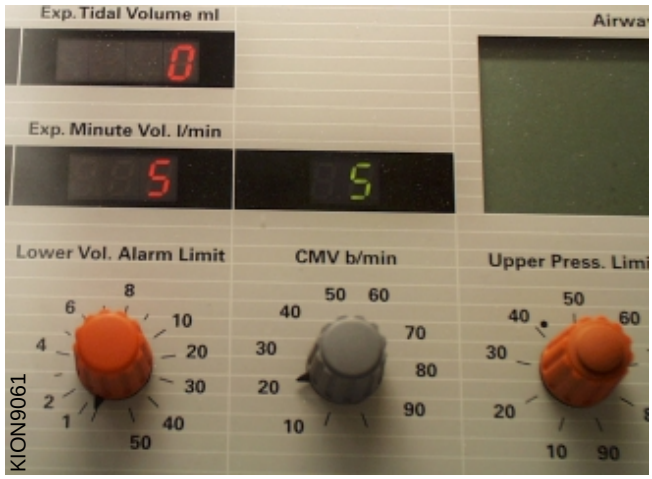
- Leakage detector. Order No. 65 03 721 E392E.
- Rubber plug kit with plugs in different diameters to plug tubes, outlets, etc. during troubleshooting. Order No. 65 03 739 E392E.
- Calibration manometer. Order No. 61 03 527 E037E.
- Voltmeter.
- Leakage detection spray.

Technical error codes showed during the ”Pre-use check”

If the ”Pre-use check” failes, a technical error code can be indicated on the Kion Display and on the Control panel. A description of these error codes can be found in the table below.

- Kion Display – Four digit code ”990**X**” stated to the left of the leakage check texts in the ”Pre-use check” window. The error code in the example below is **5** (990**5**).
- Control panel – One digit code ”**X**” stated in the digital displays for ”Exp Minute Vol.” and ”CMV”. The error code in the example below is **5** .





Error code	Possible causes	Recommended action
Code 1	Problem when loading / reading the software in KION. Possible cause: 1. Software failure.	1a. Restart KION. 1b. Replace PC 1730 CONTROL.
Code 2	Initial pressure 40 cm H_2O was not obtained within 10 s; the Pre-use check could not be started. Obtained initial pressure is showed in the digital display “Fresh gas flow“. Possible cause: 1. Leakage >19 l/min (disconnect).	1a. Check that the Auxiliary fresh gas outlet is closed. 1b. Check that the Multi-gas module sampling tube is connected. 1c. Ensure that upper pressure limit is set to 70 cm H_2O. 1d. Replace the manual breathing bag (if the error occured during the “Leakage manual ventilation“-test). 1e. Check for leakage in the system.[1]

[1] For further information, see section ”If the Pre-use check fails” in this chapter.

Error code	Possible causes	Recommended action
Code 3	Start pressure mean value cannot be calculated. Possible cause: 1. Software failure.	1a. Restart KION. 1b. Replace PC 1730 CONTROL.
Code 4	End pressure mean value cannot be calculated. Possible cause: 1. Software failure.	1a. Restart KION. 1b. Replace PC 1730 CONTROL.
Code 5	End pressure more than 1 cm H_2O higher than Start pressure. Possible cause: 1. Gas leakage into the system.	1a. Check that the Multi-gas module sampling tube including water trap is connected and not defective. 1b. Check that the Emergency O_2 valve is closed. 1c. Check for leakage into the system as described in section "If the Pre-use check fails", Step 10.
Code 6	The system is not evacuated within 10 s after the last pressure increase. Remaining pressure, showed in the digital display "Fresh gas flow", is higher than 1.5 cm H_2O. Possible causes: 1. Manual breathing bag failure (if the error occured during "Leakage manual ventilation"-test). 2. Pressure transducer calibration failure. 3. Gas leakage into the system. 4. Failure in the mushroom valve function. 5. Failure in the expiratory valve function.	1. Replace the manual breathing bag (if the error occured during the "Leakage manual ventilation"-test. 2. Calibrate KION. 3. Check for leakage into the system as described in section "If the Pre-use check fails", Step 10. 4. Check the mushroom valve function. 5. Check the expiratory valve.
Code 7	Start pressure 41 cm H_2O could not be kept though five attempts were made; the Pre-use check could not be completed. Obtained start pressure is showed in the digital display "Fresh gas flow". Possible cause: 1. Leakage 6 - 19 l/min.	1a. Check that the Multi-gas module sampling tube including water trap is connected and not defective. 1b. Check that the Emergency O_2 valve is closed. 1c. Replace the manual breathing bag (if the error occured during the "Leakage manual ventilation"-test). 1d. Check for leakage in the system.[1]

[1] For further information, see section "If the Pre-use check fails" in this chapter.

Error code	Possible causes	Recommended action
Code 8	Communication error between KION and KION Display. Possible cause: 1. Software failure.	1a. Restart KION Display. 1b. Restart KION. 1c. Replace PC 1730 CONTROL.
Code 9	Leakage >200 ml/min between the gas modules AIR (N_2O) / O_2 and the one-way valve OV4. Possible cause: 1. Gas leakage in the system.	1. Check for leakage as described in section "If the Pre-use check fails", Steps 5 – 8.

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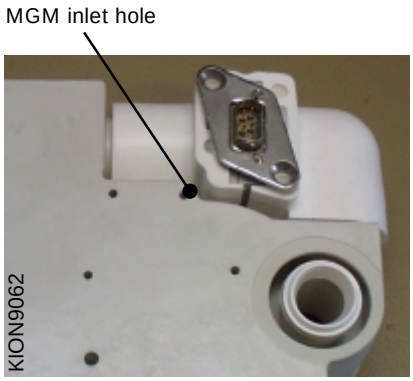
If the ”Pre-use check” fails

”Leakage automatic ventilation” test fails

Possible causes	Recommended action
Step 1 Leakage in the CO_2 Absorber.	• Remove the CO_2 Absorber. The CO_2 Absorber inlet and outlet channels in the patient cassette will now be closed by the two spring-loaded valves inside the patient cassette. • Redo the ”Leakage automatic ventilation” test. • If the test passes, the malfunction was located to the CO_2 Absorber. Check the CO_2 Absorber and mount the absorber into the Kion System. • Restart the ”Pre-use check”. If the test still fails, continue with ”Step 2”.
Step 2 Leakage in the Patient cassette.	• Check / replace the patient cassette. • Redo the ”Leakage automatic ventilation” test. • If the test passes, the malfunction was located to the patient cassette. • If the test still fails, continue with ”Step 3”.
Step 3 Leakage in the patient cassette docking station's silicone muff.	• Check the silicone muff. Check that the bacteria filters are correctly mounted into the silicone muff and that the silicone muff is correctly mounted into the docking station. • Redo the ”Leakage automatic ventilation” test. • If the test passes, the malfunction was located to the silicone muff. • If the test still fails, continue with ”Step 4”.

Possible causes	Recommended action
Step 4 Leakage in the Multi-gas module.  	• Disconnect the Multi-gas module from the KION system: – Disconnect the MGM sampling tube and plug the sampling outlet on the Y-piece (or use an Y-piece without sampling outlet). – Plug the MGM return gas channel e. g. by covering the MGM inlet hole on the patient cassette with a piece of adhesive tape. • Redo the ”Leakage automatic ventilation” test. • If the test passes, the malfunction was located to the Multi-gas module. Check the Multi-gas module. Remove the adhesive tape from the patient cassette. • If the test still fails, continue with ”Step 5”.
Step 5 Leakage in the vaporizer section.	• Disconnect the vaporizer section as follows: – Remove the plastic cable cover underneath the vaporizer magazine. – Disconnect the vaporizer magazine inlet and outlet tubes underneath the vaporizer magazine. – Insert the smaller inlet tube firmly into the larger outlet tube. • Redo the ”Leakage automatic ventilation” test. • If the test passes, the malfunction was located to the vaporizer section. Reconnect the vaporizer magazine inlet and outlet tubes. Check the: – Vaporizer magazine – Vaporizers. • Redo the ”Leakage automatic ventilation” test. If the test still fails, continue with ”Step 6”.

Possible causes	Recommended action
Step 6 Leakage in the "fresh gas to vaporizer" channel. This leakage test starts at the connection point for the gas modules AIR(N_2O) - BP and O_2 - BP into the inspiratory gas block and ends at the vaporizer magazine gas inlet.	• Disconnect the vaporizer magazine inlet tube (the tube with the smaller diameter). • Connect the leakage detector to the inlet tube. • Pressurize the mix gas channel using the leakage detector. A suitable pressure is 4 – 5 kPa (40 – 50 cm H_2O). • If the pressure indicated on the manometer drops, there is a leakage in the mix gas channel. Check the: – Gas module connections – Safety valve SV1. • Reconnect the vaporizer magazine inlet tube. • Redo the "Leakage automatic ventilation" test. If the test still fails, continue with "Step 7".
Step 7 Leakage in the "fresh gas from vaporizer" channel. This leakage test starts at the vaporizer magazine outlet and ends at the one-way valve OV4.	• Disconnect the vaporizer magazine outlet tube underneath the vaporizer magazine (the tube with the larger diameter). • Connect the leakage detector to the outlet tube. • Open the auxiliary fresh gas outlet valve (lever in horizontal position). • Plug the auxiliary fresh gas outlet. • Pressurize the fresh gas channel using the leakage detector. A suitable pressure is 4 – 5 kPa (40 – 50 cm H_2O). • If the pressure indicated on the manometer drops, there is a leakage in the fresh gas channel. Check the: – Fresh gas pressure container – Safety valve SV3 – Inspiratory flow meter and fresh gas valve channel. • Reconnect the vaporizer magazine outlet tube. • Close the auxiliary fresh gas outlet valve and remove the plug from the gas outlet. • Redo the "Leakage automatic ventilation" test. If the test still fails, continue with "Step 8".

Possible causes	Recommended action
Step 8 Leakage in the "fresh gas to breathing system" channel. This leakage test starts at the one-way valve OV4 and ends at the auxiliary fresh gas outlet.	• Open the auxiliary fresh gas outlet valve (lever in horizontal position). • Connect the leakage detector to the auxiliary fresh gas outlet. • Pressurize the fresh gas channel using the leakage detector. A suitable pressure is 4 – 5 kPa (40 – 50 cm H_2O). • If the pressure indicated on the manometer drops, there is a leakage in the fresh gas channel. Check the: – Auxiliary fresh gas outlet valve – Instant O_2 Supply valve block including the tube and the two quick couplings in the "Instant O_2 patient supply" – One-way valve OV4 – Safety valve SV4. • Redo the "Leakage automatic ventilation" test. If the test still fails, continue with "Step 9".

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Possible causes	Recommended action
Step 9 Leakage in the patient unit. This leakage test includes: – Patient cassette docking – Rebreathing section – CO_2 Absorber (if connected) – Auxiliary fresh gas outlet.	• Disconnect all gas supply to the KION System, hospital central gas supply as well as backup gas supply. • Depressurize the mushroom valves; open and close the patient cassette docking station once. • Disconnect and plug the: – Rebreathing drive gas tube at the inspiratory gas block. – Fresh gas to patient tube at the inspiratory gas block. – Expiratory gas tube at the expiratory valve. • Disconnect the MGM sampling tube and plug the sampling outlet on the Y-piece (or use an Y-piece without sampling outlet). • Disconnect the manual breathing bag and plug the outlet in the patient cassette. • Remove the valve discs in both uni-directional valves (on the patient cassette). • Connect the leakage detector to the Y-piece. • Pressurize the patient unit using the leakage detector. A suitable pressure is 4 – 5 kPa (40 – 50 cm H_2O). • If the pressure indicated on the manometer drops, there is a leakage in the patient unit. Check all parts included in this leakage test. • Remove all plugs, reconnect all tubes, mount both uni-directional valves and reconnect the gas supply. • Redo the ”Leakage automatic ventilation” test. If the test still fails, continue with ”Step 10”. **Note** A possible cause to leakage from the patient unit that is <u>not</u> detected by the test described above is that the pressure inside the mushroom valves is too low. If so, the mushroom valves will not be able to keep the system tight. Such leakage can e. g. fill the manual breathing bag during the ”Leakage automatic ventilation” test. The pressure inside the mushroom valves is regulated by REG 1 at the Gas distribution block. REG 1 is factory preset to 20 kPa. It is important that the adjustment screw on the regulator is secured with a threadlocking adhesive.

Possible causes	Recommended action
Step 10 Leakage into the system. If there is a gas leakage into the system during the "Pre-use check", this may result in two different technical error codes: – Code 9905 if the End pressure is more than 1 cm H_2O higher than the Start pressure. – Code 9906 if the leakage into the system will raise the pressure in the system above 70 cm H_2O (as set on the upper pressure limit knob). The system will then be evacuated by the expiratory valve and the "Leakage automatic ventilation" test will fail.	• Check all mushroom valves or replace the mushroom valve assembly plate. • Redo the "Leakage automatic ventilation" test. If the test still fails, continue as described below. • Disconnect the vaporizer magazine inlet tube underneath the vaporizer magazine (the tube with the smaller diameter). • Connect the leakage detector to the inlet tube. • If there is a pressure raise indicated on the manometer, it may be a leakage into the system from the gas modules AIR (N_2O) - BP or O_2 - BP. Check the gas modules. • Reconnect the vaporizer magazine inlet tube. • Redo the "Leakage automatic ventilation" test. If the test still fails, continue as described below. • Connect the leakage detector to the auxiliary fresh gas outlet. • Open the auxiliary fresh gas outlet valve (lever in horizontal position). • If there is a pressure raise indicated on the manometer, it may be a leakage into the system from the Instant O_2 Supply block. Check the Instant O_2 Supply block. • Close the auxiliary fresh gas outlet valve. • Redo the "Leakage automatic ventilation" test. If the test still fails, continue as described below. • Disconnect the rebreathing drive gas tube from the inspiratory gas block. • Connect the leakage detector to the inspiratory gas block. Use a short tube as an adapter. • If there is a pressure raise indicated on the manometer, it may be a leakage into the system from the drive gas module. Check the drive gas module. • Reconnect the rebreathing drive gas tube. • Redo the "Leakage automatic ventilation" test. If the test still fails, contact Siemens-Elema, Technical Service Support.

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”Leakage manual ventilation” test fails

Possible causes	Recommended action
Step 11 Leakage in manual breathing bag tube or in the manual breathing bag.	• Replace the manual breathing bag tube and/or the manual breathing bag. • Redo the ”Leakage manual ventilation” test. • If the test passes, the malfunction was located to the manual breathing bag tube and/or the manual breathing bag. • If the test still fails, contact Siemens-Elema, Technical Service Support.

”Checking flow transducers” test fails

Possible causes	Recommended action
Step 12 The flow transducers are tested and calibrated during this sequence of the ”Pre-use check”. If this test fails (and the two leakage tests have been performed and passed), there is probably a hardware or software failure. The different steps in this test are indicated on the control panel. This information makes it possible to descide if it is Fresh gas flow measuring or the Expiratory flow measuring that fails.	• If the Fresh gas flow measuring fails: – Replace the Fresh gas flow transducer. – Replace PC 1748 Fresh gas flow. – Replace PC 1730 Control (connected to PC 1748 Fresh gas flow via PC 1733 Interconnection). • If the Expiratory flow measuring fails: – Check the docking station/ flow transducer connectors (P121/N121). – Replace the Expiratory flow transducer. – Replace PC 1750 Transducer (connected to the Expiratory flow transducer via PC 1733 Inter-connection). – Replace PC 1737 Measuring. • Redo the ”Checking flow transducers” test after each action. • If the test passes, the malfunction was located. • If the test still fails, contact Siemens-Elema, Technical Service Support.

”Checking bellows level detector” test fails

Possible causes	Recommended action
Step 13 The bellows position sensor is not able to detect the white plastic ring on the upper part of the rebreathing bellows.	• Clean the bellows container and the ”window” on the bellows position sensor. • Check the bellows position sensor function – Connect a voltmeter between connector P46/Pin C9 on PC 1750 Transducer and GND. – Cover the bellows position sensor ”window” with a white paper. – If there is +5 V at P46/Pin C9 when the bellows position sensor ”window” is covered; replace PC 1750 Transducer. – If there is 0 V at P46/Pin C9 when the bellows position sensor ”window” is covered; replace PC 1766 Bellows position sensor or the cable connecting PC 1766 / PC 1733. • Redo the ”Checking flow transducers” test after each action. • If the test passes, the malfunction was located. • If the test still fails, contact Siemens-Elema, Technical Service Support.

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Other technical errors

Problem	Possible causes	Recommended action
The KION System will not start – Alarm indicator lamp on the control panel is flashing.	Power On Reset (POR) inhibits the microprocessor functions.	• Check cables and cable connectors. • Check that the software in the different subsystem are compatible with each other. • Replace PC 1730 Control includings its CON-SW. • Replace PC 1737 Measuring and/or the MEA-PROM. • Replace PC 1672 Control Panel and/or the PAN-PROM.
The KION System will only run in battery mode.	The AC/DC Converter will not supply power to the Power & Communication Interface.	• Check cables and cable connectors. • Check the fuses in the AC/DC Converter. • Replace the fuses in the AC/DC Converter.
The KION System will not run in battery mode.	The Internal battery will not supply power to the Power & Communication Interface.	• Check cables and cable connectors. • Check Internal battery. • Check the fuses F1 and F2 on PC 1675 Power Supply

Problem	Possible causes	Recommended action
The measured "Exp. Minute vol." value is not stabile.	1. Leakage at the uni-directional valves.	1. Replace the uni-directional valves.
	2. Failure in the expiratory flow transducer.	2. Clean/replace the expiratory flow transducer.
	3. Poor contact between the expiratory flow transducer and the connector in the docking station.	3a. Replace the expiratory flow transducer. 3b. Replace the contact in the docking station.
	4. Failure in the fresh gas flow transducer. This failure can be indicated as a big difference between the set "Minute Volume" and the measured "Exp. Minute vol.".	4. Replace the fresh gas flow transducer.
	5. Failure in the gas modules.	5. Replace the gas modules, one at the time.
Leakage in the Luer-lock connections for the pressure transducer tubes (on PC 1750 TRANSDUCER).	The threads in the plastic Luer-lock connector is damaged.	Replace the plastic Luer-lock connector.
Software not responding due to poor electric contact:		
1. All control panel displays for measured values are black.	1. Poor contact at the MEA-PROM.	1. Check the contact pins on the MEA-PROM and in the PROM socket.
2. All control panel displays are black.	2. Poor contact at the ALA-PROM or at the PAN-PROM.	2. Check the contact pins on the ALA-PROM or on the PAN-PROM and in the PROM sockets.
3. The control panel lights up only during the start-up sequence or the control panel displays for set values are black.	3. Poor contact at the connector for the PC 1730 CONTROL.	3. Check the connection of the PC 1730 CONTROL.

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Technical alarms and Diagnostic logs

General

There are two diagnostic logs stored in the KION System. These diagnostic logs captures data about hardware and software performance relating to the KION System and they can be used by the FSE during troubleshooting of the KION System. The diagnostic logs can be displayed on the KION Display and copied to other medias.

The two diagnostic log are:

- The "**Diagnostic Log**", stored in the KION Display. The Diagnostic Log contains Diagnostic Log numbers (the number within brackets).
- The "**CPS/IDS Diag. Log**", stored in the Communication Interface (CPS). The CPS/IDS Diag. Log contains CAN DATA (HEX).

Boths logs are explained in the Diagnostic log tables on the following pages.

The Siemens PICK AND GO concept allows a KION Display to be moved between different KION Systems. The "**Diagnostic Log**", stored in the KION Display, may thus contain Diagnostic Logs from different KION Systems.

Displaying the diagnostic logs

To show the diagnostic logs on the KION Display, select:

Menu / Monitor Setup / Biomed / Logs / Diagnostic Log

or

Menu / Monitor Setup / Biomed / Logs / CPS/IDS Diag. Log

Diagnostic Log contents

An example of a Diagnostic Log can be found in the illustration below. The following information is displayed in the Diagnostic Log:

- Total Number Of Diagnostic Events: Number of diagnostic events stored in the memory.
- SW Version: Software version installed in the KION Display.
- Product Serial #: KION Display serial number.
- Diagnostic Number: Not intended for service purpose.
- Class: Not intended for service purpose.
- Time: Time stamp (h:min) of the event.
- Date: Date stamp (month/day/year) of the event.
- Dup Cnt: Counts how many times this diagnostic has been logged.
- Line #: Not intended for service purpose.
- Description: Description of the log incl. Diagnostic Log number within brackets.

Diagnostic Log

Total Number Of Diagnostic Events: 252 Product Serial #: 5220606772
SW Version: VC2.2

Events Are Displayed Newest To Oldest

	Diagnostic Number	Class	Time	Date	Dup Cnt	Line #	Description
1	0x8038b03d	SW-WRN	16:37	2/18/99	0	5019	AMGM CRITICAL FAIL (100)
	0x8038b037	SW-WRN	16:37	2/18/99	1	11070	CANbus Diag (27)
	0x8038b03e	SW-WRN	16:37	2/18/99	0	11070	CANbus Diag (27)
	0x8038b037	SW-WRN	16:35	2/18/99	0	11063	CANbus Diag (104)
2	0x8038b037	SW-WRN	16:20	2/18/99	1	11070	MGM/MGI failure (560)
	0x8038b03e	SW-WRN	16:20	2/18/99	0	11070	CANbus Diag (610)
	0x8038b03e	SW-WRN	16:19	2/18/99	2	11063	CANbus Diag (616)
3	0x8038b037	SW-WRN	16:18	2/18/99	0	11063	CANbus Diag (407)
	0x8038b03d	SW-WRN	16:17	2/18/99	7	5019	AMGM CRITICAL FAIL (100)
	0x8038b03d	SW-WRN	16:17	2/18/99	0	11070	CANbus Diag (28)
	0x8038b03d	SW-WRN	16:15	2/18/99	0	5019	AMGM CRITICAL FAIL (100)
	0x8038b03e	SW-WRN	16:15	2/18/99	0	11063	CANbus Diag (101)

CPS/IDS Diag. Log contents

An example of a CPS/IDS Diag. Log can be found in the illustration below. The following information is displayed in the CPS/IDS Diag. Log:

- Total Number Of Diagnostic Events: Number of diagnostic events stored in the memory.
- SW Version: Software version installed in the CPS.
- Product Serial #: CPS serial number.
- Diagnostic Number: Not intended for service purpose.
- Class: Not intended for service purpose.
- Time: Time stamp (h:min) of the event.
- Date: Date stamp (month/day/year) of the event. **Note**: Time and date is controlled by the real time clock in the KION Display. If no KION Display is connected to the KION System or if communication is not established (e. g. during startup of the system), the Time and Date stamp in the CPS/IDS Diag. Log will be 12:00 1/1/93.
- Dup Cnt: Counts how many times this diagnostic has been logged.
- Line #: Not intended for service purpose.
- Description: Description of the log in HEX-code. **Note**: Only a minor part of the log is used to identify the cause for the log and a recommended action during field service. This is explained in the Diagnostic log tables on the following pages. The complete log contains information that can be analyzed only by personnel with advanced knowledge in the KION software, e. g. KION Support Specialists.

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CPS/IDS Diagnostic Log

Total Number Of Diagnostic Events: 252 Product Serial #: 3920071276
SW Version: VC0.1

Events Are Displayed Newest To Oldest

	Diagnostic Number	Class	Time	Date	Dup Cnt	Line #	Description
1	0x8038b03d	WRN	16:37	2/18/99	2	5019	CAN DATA (HEX): 9463, 55, 00, 1B, CF, 00, 6C, 02, 00
	0x8038b037	WRN	16:37	2/18/99	1	11070	CAN DATA (HEX): 9463, 55, 00, 1B, CF, 00, 6C, 02, 00
	0x8038b03e	WRN	16:37	2/18/99	0	11070	CAN DATA (HEX): 9463, 55, 00, 1B, CF, 00, 6C, 02, 00
	0x8038b037	WRN	16:35	2/18/99	0	11063	CAN DATA (HEX): 9463, 55, 00, 68, 03, 00, CC, 02, 01
2	0x8038b037	WRN	16:20	2/18/99	1	11070	CAN DATA (HEX): 9463, 55, 02, 62, 00, A5, 6C, 01, 02
	0x8038b03e	WRN	16:20	2/18/99	0	11070	CAN DATA (HEX): 9463, 55, 02, 62, 00, A5, 6C, 01, 02
	0x8038b03e	WRN	16:19	2/18/99	2	11063	CAN DATA (HEX): 9463, 55, 02, 68, 03, 35, A5, 00, 55
3	0x8038b037	WRN	16:18	2/18/99	0	11063	CAN DATA (HEX): 9463, 55, 01, 97, D4, 01, 02, 00, 00
	0x8038b03d	WRN	16:17	2/18/99	1	5019	CAN DATA (HEX): 9463, 55, 00, 1B, CF, 00, 6C, 02, 00
	0x8038b03d	WRN	16:17	2/18/99	1	11070	CAN DATA (HEX): 9463, 55, 02, 68, 03, 35, A5, 00, 55
	0x8038b03d	WRN	16:15	2/18/99	0	5019	CAN DATA (HEX): 9463, 55, 00, 1B, CF, 00, 6C, 02, 00
	0x8038b03e	WRN	16:15	2/18/99	0	11063	CAN DATA (HEX): 9463, 55, 02, 68, 03, 35, A5, 00, 55

Diagnostic log groups

The diagnostic logs can be divided into three main groups:

1. Technical Alarm-diagnostics.
2. Reduced Functionality-diagnostics.
3. Other Diagnostics.

Technical Alarm-diagnostics

The diagnostic logs in this group are listed in the "Diagnostic log table – Technical Alarms" on the following pages.

A Technical Alarm is always stated with the log number **100** in the Diagnostic Log. This log is always combined with one or several logs indicating the actual error.

In example 1 in the Diagnostic Log-illustration above, the Technical Alarm-log (**100**) is combined with two logs (**27**), with identical Time and Date stamp, indicating that "MEA is not responding".
The corresponding log in the CPS/IDS Diagnostic Log-illustration is **..., 55, 00, 1B, ...**.

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Reduced Functionality-diagnostics

The diagnostic logs in this group are listed in the "Diagnostic log table – Reduced Functionality" on the following pages.

Most of the Reduced Functionality-logs are combined with one or several logs indicating the actual error.

In example 2 in the Diagnostic Log-illustration above, the Reduced Functionality-log (**560**) is combined with the log (**610**), with identical Time and Date stamp, indicating "MGI, Watchdog restart".
The corresponding log in the CPS/IDS Diagnostic Log-illustration is **..., 55, 02, 62, ...**.

Other Diagnostics

The diagnostic logs in this group are listed in the "Diagnostic log table – Other Diagnostics" on the following pages.

This log group is only displayed with a log indicating the actual error.

In example 3 in the Diagnostic Log-illustration above, log (**407**) indicates "MEA: CAN - Buss off".
The corresponding log in the CPS/IDS Diag. Log-illustration is **..., 55, 01, 97, ...**.

Copying the diagnostic logs

An expanded version of the diagnostic logs can be printed on a laser printer or copied to a Data Card as described in the KION Display-documentation.

Expanded versions of the diagnostic logs can also be accessed and copied to a PC as described below.

Access the diagnostic logs from a PC

The diagnostic logs can be accessed from a PC connected to the KION System. In the description below, a PC with the software HyperTerminal (included in Windows) is used.

Connect and setup the PC as follows:

- Make sure that the PC and the KION System is turned **Off**.
- Connect an RS232 cable (Order No. 47 14 346 E530U to a **COM** port on the PC. Connect the other end of the cable to the KION System as follows:
  - For access to the "**Diagnostic Log**", connect to the **X3a** port.
  - For access to the "**CPS/IDS Diagnostic Log**", connect to the **X4** port.
- Turn the PC **On** and the KION System to **Standby**.

First time-connection and setup

- If this is the first time the PC is used for communication with the KION System, terminal settings must be made. These settings can be saved and used whenever the PC is connected to a KION System.
  - Start HyperTerminal on the PC.
  - Select a name (e. g. KION) and an icon. Klick **OK**.
  - Select the used COM port in the "Connect to" dialog box. Klick **OK**.
  - Make the following COM port-settings:

Bits per second:	19200
Data bits:	8
Parity:	None
Stop bits:	1
Flow control:	None

    Klick **OK**.
  - The HyperTerminal window will now be open and active.
  - Select **File/Save** in the HyperTerminal menu to save the settings and thereby create a HyperTerminal setting to be used whenever the PC is connected to a KION System.

- Press the **Enter** key. The ”System Console Main Menu” will now appear in the HyperTerminal window (if a sub-menu is displayed, return to the ”System Console Main Menu”).
  Communication with the KION System is established.

Connection with saved settings

- If there is a saved HyperTerminal-setting used for communication with the KION System, select this setting to start HyperTerminal. The HyperTerminal window will now be open and active.
- Press the **Enter** key. The ”System Console Main Menu” will now appear in the HyperTerminal window (if a sub-menu is displayed, return to the ”System Console Main Menu”).
  Communication with the KION System is established.

Copying the diagnostic log to a PC

The HyperTerminal program is used only as an interface for communication with the KION System. Before copying the diagnostic log to the PC, a text file must be created and used as a target for the diagnostic log .

- Establish communication between the KION System and the PC (see description above).
- Enter selection **1** (Error Services) in the ”System Console Main Menu”. Press the **Enter** key.
  The ”ERROR Driver Main Menu” will now appear.
- Select **Transfer/Capture text** in the HyperTerminal menu.
- Select a name on the target file and check/adjust the path to the file. Klick on **Start**. The target file is now ready to be used.
- Enter selection **1** (VIEW THE ERROR LOG) in the ”ERROR Driver Main Menu”. Press the **Enter** key.
  The diagnostic log will now be copied to the target file.
- Wait until the copying is completed and the ”ERROR Driver Main Menu” appears again.
- Select **Transfer/Capture text/Stop** in the HyperTerminal menu to close the target file.
- Exit the HyperTerminal program.
- It is now possible to open the target file with a suitable program, e. g. MS Word. To make it easier to read the information in the log, it is recommended to change the font (use e. g. Arial) and to delete unnecessary parts of the file.

Deleting the diagnostic log

- Establish communication between the KION System and the PC (see description above).
- Enter selection **1** (Error Services) in the ”System Console Main Menu”. Press the **Enter** key.
  The ”ERROR Driver Main Menu” will now appear.
- Enter selection **5** (CLEAR THE ERROR LOG) in the ”ERROR Driver Main Menu”. Press the **Enter** key.
  The diagnostic log will now be deleted.
- Exit the HyperTerminal program.

Disconnecting the PC from the KION System

- Make sure that the KION System is turned **Off**.
- Make sure that the PC is turned **Off**.
- Disconnect the RS232 cable between the PC and the KION System.

Diagnostic log table – Technical Alarm

Technical Alarm (100)

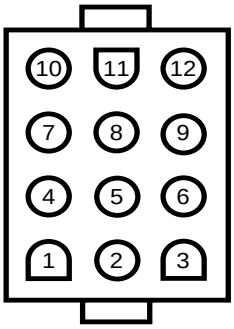
Diagnostic Log	CPS/IDS Diag. Log	Cause	Recommended action
001	..., 55, 00, 01, ...	ALA, CPU-error	Replace PC1672 CONTROL PANEL
002	..., 55, 00, 02, ...	ALA, RAM-error	Replace PC1672 CONTROL PANEL
003	..., 55, 00, 03, ...	ALA, ROM-error	Replace PC1672 CONTROL PANEL
004	..., 55, 00, 04, ...	Voltage monitoring error +5V	Replace PC1672 CONTROL PANEL
005	..., 55, 00, 05, ...	Voltage monitoring error ±15V	Replace PC1672 CONTROL PANEL
006	..., 55, 00, 06, ...	ALA, AD-converter error	Replace PC1672 CONTROL PANEL
007	..., 55, 00, 07, ...	Voltage monitoring error +24V	Replace PC1672 CONTROL PANEL
008	..., 55, 00, 08, ...	Disable valves error	Replace PC1675 POWER SUPPLY Replace PC1672 CONTROL PANEL
011	..., 55, 00, 0B, ...	MEA failed emergency line check	Replace PC1737 MEASURING
012	..., 55, 00, 0C, ...	CON failed emergency line check	Replace PC1730 CONTROL
013	..., 55, 00, 0D, ...	PAN failed emergency line check	Replace PC1672 CONTROL PANEL
015	..., 55, 00, 0F, ...	Emergency line active before check	Replace PC1737 MEASURING Replace PC1730 CONTROL Replace PC1672 CONTROL PANEL
027	..., 55, 00, 1B, ...	MEA is not responding	Replace PC1737 MEASURING Replace PC1672 CONTROL PANEL
028	..., 55, 00, 1C, ...	CON is not responding	Replace PC1730 CONTROL Replace PC1672 CONTROL PANEL
029	..., 55, 00, 1D, ...	PAN is not responding	Replace PC1672 CONTROL PANEL
031	..., 55, 00, 1F, ...	WD-test error	Replace PC1672 CONTROL PANEL
034	..., 55, 00, 22, ...	Power backup failure on the alarm unit	Replace PC1672 CONTROL PANEL
037	..., 55, 00, 25, ...	Timer-test error	Replace PC1672 CONTROL PANEL
038	..., 55, 00, 26, ...	MEA is not fully operational	Replace PC1737 MEASURING Replace PC1672 CONTROL PANEL
039	..., 55, 00, 27, ...	CON is not fully operational	Replace PC1730 CONTROL Replace PC1672 CONTROL PANEL
040	..., 55, 00, 28, ...	PAN is not fully operational	Replace PC1672 CONTROL PANEL
049	..., 55, 00, 31, ...	Emergency line error	Replace PC1737 MEASURING Replace PC1730 CONTROL Replace PC1672 CONTROL PANEL
051	..., 55, 00, 33, ...	MEA, not responding resend alarms	Replace PC1737 MEASURING
052	..., 55, 00, 34, ...	CON, not responding resend alarms	Replace PC1730 CONTROL
053	..., 55, 00, 35, ...	PAN, not responding resend alarms	Replace PC1672 CONTROL PANEL
058	..., 55, 00, 3A, ...	Off without power-off message	Check / replace ON/OFF switch Replace PC1730 CONTROL Replace PC1672 CONTROL PANEL

Diagnostic Log	CPS/IDS Diag. Log	Cause	Recommended action
059	..., 55, 00, 3B, ...	On without calibration ended	Replace PC1730 CONTROL
062	..., 55, 00, 3E, ...	Emergency buzzer error	Replace PC1672 CONTROL PANEL
101	..., 55, 00, 65, ...	CON, CPU-error	Replace PC1730 CONTROL
102	..., 55, 00, 66, ...	CON, ROM-error	Replace PC1730 CONTROL
103	..., 55, 00, 67, ...	CON, RAM-error	Replace PC1730 CONTROL
301	..., 55, 01, 2D, ...	PAN, CPU-error	Replace PC1672 CONTROL PANEL
302	..., 55, 01, 2E, ...	PAN, ROM-error	Replace PC1672 CONTROL PANEL
303	..., 55, 01, 2F, ...	PAN, RAM-error	Replace PC1672 CONTROL PANEL
304	..., 55, 01, 30, ...	PAN, Watchdog-error	Replace PC1672 CONTROL PANEL
305	..., 55, 01, 31, ...	PAN, Timer-error	Replace PC1672 CONTROL PANEL
307	..., 55, 01, 33, ...	PAN, Display-error	Replace PC1672 CONTROL PANEL
320	..., 55, 01, 40, ...	PAN, Volume alarm limit potentiometer error	Check / replace potentiometer
323	..., 55, 01, 43, ...	PAN, High pressure limit potentiometer-error	Check / replace potentiometer
229	..., 55, 00, E5, ...	Barometer pressure error	Replace PC1672 CONTROL PANEL
331	..., 55, 01, 4B, ...	ALA is not responding	Replace PC1672 CONTROL PANEL
332	..., 55, 01, 4C, ...	PAN initialisation failed	Replace PC1672 CONTROL PANEL
401	..., 55, 01, 91, ...	MEA, CPU-error	Replace PC1737 MEASURING
402	..., 55, 01, 92, ...	MEA, ROM-error	Replace PC1737 MEASURING
403	..., 55, 01, 93, ...	MEA, RAM-error	Replace PC1737 MEASURING
404	..., 55, 01, 94, ...	MEA, Watchdog-error	Replace PC1737 MEASURING
405	..., 55, 01, 95, ...	MEA, Timer-error	Replace PC1737 MEASURING
406	..., 55, 01, 96, ...	MEA, Reset-error	Replace PC1737 MEASURING
421	..., 55, 01, A5, ...	MEA, No insp exp signal from CON	Replace PC1737 MEASURING Replace PC1730 CONTROL

Diagnostic log table – Reduced Functionality

Reduced functionality (500 – 999)

Diagnostic Log	CPS/IDS Diag. Log	Cause	Recommended action
		Voltage error, valves disabled (510)	
026	..., 55, 00, 1A, ...	Voltage error, +24V.	Check if +24V_PTC is available at P59 on PC 1675 POWER SUPPLY: • If +24V_PTC is not available, replace AC/DC CONVERTER. **Note**: As the two fans inside the battery drawer runs on +24 V, this error is easy to identify by checking the function of these fans. • If +24V_PTC is available, this voltage is correctly generated by the Power Supply system. The error must be found in any of the other subsystems or in the cables/connectors.
042	..., 55, 00, 2A, ...	Voltage error, +15V	Check if +15V / -15V / 5V is available at P59 on PC 1675 POWER SUPPLY: • If +15V / -15V / 5V is not available, disconnect the POWER SUPPLY cable at P82 on PC 1753 DC/DC CONVERTER and repeat the voltage check at P59: – If the voltage still is not available, replace PC 1675 POWER SUPPLY. – If the voltage now is available, replace the COMMUNICATION INTERFACE (CPS).
043	..., 55, 00, 2B, ...	Voltage error, -15V	
055	..., 55, 00, 37, ...	Voltage error 5V	



P59 / PC 1675

1	GND
2	+15V
3	+24V_PTC
4	GND
5	-15V
6	+5V
7	GND
8	+24V_VALVE
9	+5V
10	GND
11	+24V_VALVE
12	+5V

Checking voltages

- Open the POWER & COMMUNICATION INTERFACE as described in chapter 3 "Disassembling and assembling", section Battery drawer.
- Disconnect the battery cable.
- Disconnect the POWER SUPPLY cable at P59 on PC 1675 POWER SUPPLY.
- Connect the mains power cable to the AC/DC CONVERTER cable.

> With mains power connected to the unit, there are energized electrical components inside the equipment. All personnel must exercise extreme caution when in the vicinity of this equipment if fault tracing or adjustments are performed with mains power supply connected and with the battery drawer opened.

- Switch the KION System to **Standby**.
- Using a voltmeter, check the voltage levels in connector P59 on PC 1675 POWER SUPPLY.

Diagnostic Log	CPS/IDS Diag. Log	Cause	Recommended action
		MGM / MGI failure (560)	
601	..., 55, 02, 59, ...	MGI, CPU-error	Replace PC1747 CAN/RS232 INTERFACE
602	..., 55, 02, 5A, ...	MGI, ROM-error	Replace PC1747 CAN/RS232 INTERFACE
603	..., 55, 02, 5B, ...	MGI, RAM-error	Replace PC1747 CAN/RS232 INTERFACE
610	..., 55, 02, 62, ...	MGI, Watchdog restart	Replace PC1747 CAN/RS232 INTERFACE
611	..., 55, 02, 63, ...	MGI, Timer-error	Replace PC1747 CAN/RS232 INTERFACE
612	..., 55, 02, 64, ...	MGI, Watchdog-error	Replace PC1747 CAN/RS232 INTERFACE
		MGM – O2 module error (562)	
605	..., 55, 02, 5D, ...	MGI, O2_MODULE-error	Replace MULTIGAS+ MODULE
		Alarm displaying error on the Alarm unit (830)	
032	..., 55, 00, 20, ...	ALA Alarm buzzer error.	Restart the KION System Replace PC1672 CONTROL PANEL
033	..., 55, 00, 21, ...	ALA Display error.	Replace PC1672 CONTROL PANEL
062	..., 55, 00, 3E, ...	ALA Emergency buzzer error	Restart the KION System Replace PC1672 CONTROL PANEL

Diagnostic log table – Other Diagnostics

A = Internal system log not intended for service purpose and not used by the FSE (Field Service Engineer) during troubleshooting. The log contains information that can be analyzed only by personnel with advanced knowledge in the KION software, e.g. KION Support Specialists. If not repeated, the log can be ignored.

Other diagnostics

Diagnostic Log	CPS/IDS Diag. Log	Cause	Recommended action
009	..., 55, 00, 09, ...	ALA: CAN – Receive buffer full	A
010	..., 55, 00, 0A, ...	ALA: CAN – Data overrun is detected	A
016	..., 55, 00, 10, ...	ALA: CAN – Timeout	A
019	..., 55, 00, 13, ...	ALA: CAN – Default CAN error handler	A
020	..., 55, 00, 14, ...	ALA: Tech error buffer overflow	A
023	..., 55, 00, 17, ...	ALA: Internal error	A
024	..., 55, 00, 18, ...	Low Battery Capacity, change batteries.	A
025	..., 55, 00, 19, ...	Batteries not possible to load fully, change batteries.	A
035	..., 55, 00, 23, ...	ALA: Reset	A
036	..., 55, 00, 24, ...	Silence button is stuck on the PAN.	Check / replace button.
044	..., 55, 00, 2C, ...	ALA: CAN – Buss off Solved	A
045	..., 55, 00, 2D, ...	ALA: CAN – Incorrect message to send	A
046	..., 55, 00, 2E, ...	ON/STANDBY/OFF-switch error.	Check / replace switch
047	..., 55, 00, 2F, ...	Low battery capacity at startup	A
048	..., 55, 00, 30, ...	Battery test time error	A
056	..., 55, 00, 38, ...	PWR – Fan failure	Check / replace fans (Battery drawer fan and AC/DC Converter fan).
057	..., 55, 00, 39, ...	Power-off message without off	Restart the KION System
060	..., 55, 00, 3C, ...	ALA: AD converter start error	Replace PC1672 CONTROL PANEL
061	..., 55, 00, 3D, ...	ALA: AD converter read error	Replace PC1672 CONTROL PANEL
063	..., 55, 00, 3F, ...	ALA system configuration data EE-Prom CRC error	Replace PC1672 CONTROL PANEL
064	..., 55, 00, 40, ...	ALA internal diagnostics	A
065	..., 55, 00, 41, ...	ALA internal diagnostics	A
066	..., 55, 00, 42, ...	ALA internal diagnostics	A
067	..., 55, 00, 43, ...	ALA internal diagnostics	A
068	..., 55, 00, 44, ...	ALA internal diagnostics	A
069	..., 55, 00, 45, ...	ALA internal diagnostics	A
070	..., 55, 00, 46, ...	ALA internal diagnostics	A
071	..., 55, 00, 47, ...	ALA internal diagnostics	A
072	..., 55, 00, 48, ...	ALA internal diagnostics	A
073	..., 55, 00, 49, ...	ALA internal diagnostics	A
074	..., 55, 00, 4A, ...	ALA internal diagnostics	A
075	..., 55, 00, 4B, ...	ALA internal diagnostics	A
104	..., 55, 00, 68, ...	CON: CAN - Buss off Solved	A

Diagnostic Log	CPS/IDS Diag. Log	Cause	Recommended action
105	..., 55, 00, 69, ...	CON: CAN - Receive buffer full	A
106	..., 55, 00, 6A, ...	CON: CAN - Data overrun is detected	A
109	..., 55, 00, 6D, ...	CON: CAN - Warning limit is reached	A
112	..., 55, 00, 70, ...	DIAG_CAN_READ_ERRROR	A
113	..., 55, 00, 71, ...	DIAG_CAN_UNKNOWN_MESSAGE	A
120	..., 55, 00, 78, ...	DIAG_SW_INFO	A
121	..., 55, 00, 79, ...	DIAG_UNEXPECTED_SW_EVENT	A
122	..., 55, 00, 7A, ...	DIAG_SW_INFO_DIAG,	A
123	..., 55, 00, 7B, ...	DIAG_SW_INFO_RUBUS_C	A
124	..., 55, 00, 7C, ...	DIAG_SW_INFO_DRV_CAN,	A
125	..., 55, 00, 7D, ...	DIAG_SW_INFO_DRV_HAL,	A
126	..., 55, 00, 7E, ...	DIAG_SW_INFO_DRV_IN,	A
127	..., 55, 00, 7F, ...	DIAG_SW_INFO_DRV_OUT,	A
128	..., 55, 00, 80, ...	DIAG_SW_INFO_DRV_SIGN,	A
129	..., 55, 00, 81, ...	DIAG_SW_INFO_DRV_TIME,	A
130	..., 55, 00, 82, ...	DIAG_SW_INFO_DRV_WD	A
131	..., 55, 00, 83, ...	DIAG_SW_INFO_MOD_CON	A
132	..., 55, 00, 84, ...	DIAG_SW_INFO_MOD_RTOS	A
133	..., 55, 00, 85, ...	DIAG_SW_INFO_MOD_SYS	A
134	..., 55, 00, 86, ...	DIAG_SW_INFO_CONTROL	A
135	..., 55, 00, 87, ...	DIAG_SW_INFO_ALA_PRO	A
136	..., 55, 00, 88, ...	DIAG_SW_INFO_CAL_E2P	A
137	..., 55, 00, 89, ...	DIAG_SW_INFO_CAL_GLO	A
138	..., 55, 00, 8A, ...	DIAG_SW_INFO_CAL_LEAK	A
139	..., 55, 00, 8B, ...	DIAG_SW_INFO_CAL_MISC	A
140	..., 55, 00, 8C, ...	DIAG_SW_INFO_CAL_POS	A
141	..., 55, 00, 8D, ...	DIAG_SW_INFO_CAL_PRO	A
142	..., 55, 00, 8E, ...	DIAG_SW_INFO_CAL_SENS	A
143	..., 55, 00, 8F, ...	DIAG_SW_INFO_CAL_VALV	A
144	..., 55, 00, 90, ...	DIAG_SW_INFO_COM_IN	A
145	..., 55, 00, 91, ...	DIAG_SW_INFO_COM_OUT	A
146	..., 55, 00, 92, ...	DIAG_SW_INFO_COM_DATA	A
147	..., 55, 00, 93, ...	DIAG_SW_INFO_COM_PRO	A
148	..., 55, 00, 94, ...	DIAG_SW_INFO_DGAS_PRO	A
149	..., 55, 00, 95, ...	DIAG_SW_INFO_FGAS_PRO	A
150	..., 55, 00, 96, ...	DIAG_SW_INFO_ISYN_PRO	A
151	..., 55, 00, 97, ...	DIAG_SW_INFO_MIX_PRO	A
152	..., 55, 00, 98, ...	DIAG_SW_INFO_OSYN_PRO	A
153	..., 55, 00, 99, ...	DIAG_SW_INFO_PEEP_PRO	A

Diagnostic Log	CPS/IDS Diag. Log	Cause	Recommended action
154	..., 55, 00, 9A, ...	DIAG_SW_INFO_POLL_PRO	A
155	..., 55, 00, 9B, ...	DIAG_SW_INFO_SANA_PRO	A
156	..., 55, 00, 9C, ...	DIAG_SW_INFO_SCON_EXP	A
157	..., 55, 00, 9D, ...	DIAG_SW_INFO_SCON_GLO	A
158	..., 55, 00, 9E, ...	DIAG_SW_INFO_SCON_INI	A
159	..., 55, 00, 9F, ...	DIAG_SW_INFO_SCON_PRO	A
160	..., 55, 00, A0, ...	DIAG_SW_INFO_SCON_STA	A
161	..., 55, 00, A1, ...	DIAG_SW_INFO_SUP_PRO	A
200	..., 55, 00, C8, ...	DIAG_FGAS_FAILURE	Run a ”Pre-use check” to calibrate the fresh gas flow transducer. Check that the inspiratory fresh gas valve tube is correctly mounted. Check that the inspiratory fresh gas valve works properly.
201	..., 55, 00, C9, ...	DIAG_FGAS_FAILURE_NO_LONGER	Run a ”Pre-use check” to calibrate the fresh gas flow transducer. Check that the inspiratory fresh gas valve tube is correctly mounted. Check that the inspiratory fresh gas valve works properly.
202	..., 55, 00, CA, ...	DIAG_MIX_NO_EMPTY_DETECTION	A
230	..., 55, 00, E6, ...	DIAG_USER_INTERACTION_TIMEOUT	A
231	..., 55, 00, E7, ...	DIAG_HERC_TIMEOUT	A
232	..., 55, 00, E8, ...	DIAG_INTERNAL_LEAKAGE	Check for leakage in the rebreathing section
233	..., 55, 00, E9, ...	DIAG_LOW_MIX_VALVE_SUPPLY	A
234	..., 55, 00, EA, ...	DIAG_LOW_O2_VALVE_SUPPLY	A
298	..., 55, 01, 2A, ...	DIAG_TEST_AUTO_CLEARED	A
299	..., 55, 01, 2B, ...	DIAG_TEST_NOT_AUTO_CLEARED.	A
306	..., 55, 01, 32, ...	PAN: Reset	A
308	..., 55, 01, 34, ...	PAN: CAN - Buss off Solved	A
309	..., 55, 01, 35, ...	PAN: CAN - Receive buffer full	A
310	..., 55, 01, 36, ...	PAN: CAN - Data overrun is detected	A
312	..., 55, 01, 38, ...	PAN: CAN - Timeout	A
313	..., 55, 01, 39, ...	PAN: CAN - Warning limit is reached	A
316	..., 55, 01, 3C, ...	PAN, Fresh gas flow potentiometer-error	Check / replace potentiometer Replace PC1672 CONTROL PANEL
317	..., 55, 01, 3D, ...	PAN, O2 concentration potentiometer-error	Check / replace potentiometer Replace PC1672 CONTROL PANEL
318	..., 55, 01, 3E, ...	PAN, Gas combination potentiometer-error	Check / replace switch Replace PC1672 CONTROL PANEL
319	..., 55, 01, 3F, ...	PAN, Minute volume potentiometer-error	Check / replace potentiometer Replace PC1672 CONTROL PANEL

Diagnostic Log	CPS/IDS Diag. Log	Cause	Recommended action
321	..., 55, 01, 41, ...	PAN, Breath rate potentiometer-error	Check / replace potentiometer Replace PC1672 CONTROL PANEL
322	..., 55, 01, 42, ...	PAN, Pressure level potentiometer-error	Check / replace potentiometer Replace PC1672 CONTROL PANEL
324	..., 55, 01, 44, ...	PAN, Insp time potentiometer-error	Check / replace potentiometer Replace PC1672 CONTROL PANEL
325	..., 55, 01, 45, ...	PAN, PEEP level potentiometer-error	Check / replace potentiometer Replace PC1672 CONTROL PANEL
326	..., 55, 01, 46, ...	PAN, Trigg sense potentiometer-error	Check / replace potentiometer Replace PC1672 CONTROL PANEL
327	..., 55, 01, 47, ...	PAN, Ventilation mode potentiometer-error	Check / replace switch Replace PC1672 CONTROL PANEL
328	..., 55, 01, 48, ...	PAN, Breath mode potentiometer-error	Check / replace switch Replace PC1672 CONTROL PANEL
330	..., 55, 01, 4A, ...	PAN, A/D read error	Replace PC1672 CONTROL PANEL
333	..., 55, 01, 4D, ...	SW error	A
407	..., 55, 01, 97, ...	MEA: CAN - Buss off	A
408	..., 55, 01, 98, ...	MEA: CAN - Buss off Solved	A
409	..., 55, 01, 99, ...	MEA: CAN - Receive buffer full	A
410	..., 55, 01, 9A, ...	MEA: CAN - Data overrun is detected	A
411	..., 55, 01, 9B, ...	MEA: CAN - Incorrect message to send	A
412	..., 55, 01, 9C, ...	MEA: CAN - Timeout	A
413	..., 55, 01, 9D, ...	MEA: CAN - Warning limit is reached	A
415	..., 55, 01, 9F, ...	MEA: CAN - Unknown CAN message	A
416	..., 55, 01, A0, ...	MEA: AD-error (single fault)	Replace PC1737 MEASURING
417	..., 55, 01, A1, ...	MEA: AD-error (double fault)	Replace PC1737 MEASURING
419	..., 55, 01, A3, ...	MEA: Internal-error	A
420	..., 55. 01, A4, ...	MEA: No data from MGM	A
604	..., 55, 02, 5C, ...	MGI, CHECKSUM-error	A
606	..., 55, 02, 5E, ...	MGI, COMMAND_TIMEOUT-error	A
607	..., 55, 02, 5F, ...	MGI, CONTINUOUS_DATA_TIMEOUT-error	A
608	..., 55, 02, 60, ...	MGI, STATUS_TIMEOUT-error	A
609	..., 55, 02, 61, ...	MGI, PATIENT_DATA_TIMEOUT-error	A
613	..., 55, 02, 65, ...	MGI: Reset	A
614	..., 55, 02, 66, ...	MGI: CAN - Warning limit is reached	A
615	..., 55, 02, 67, ...	MGI, CAN BUS-error	A
616	..., 55, 02, 68, ...	MGI: CAN - Receive buffer full	A
617	..., 55, 02, 69, ...	MGI: CAN - Data overrun is detected	A

Notes

6. Maintenance

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Maintenance, service and repair of the KION System must be done by personnel authorized by Siemens.

Any maintenance must be noted in a log book provided for that purpose in accordance with local regulations.

All disposable parts must be discarded according to local regulations and in an environmentally safe way.

In combination with the "Twelve months maintenance" as described in this chapter, a "Routine cleaning" must be performed. Refer to the "KION – Operating Manual" for details.

After any maintenance of the KION System, perform a "Function check" and a "Calibration". Refer to the "KION – Operating Manual" for details.

General

Maintenance, service and repair of the KION System must be done by personnel authorized by Siemens.

A "Twelve months maintenance" must be performed every twelve months or every 3000 hours of operation whichever comes first. All service and maintenance should be noted in the KION Systems log book.

After or in combination with performing the "Twelve months maintenance" described in this chapter, a routine cleaning must be performed. Refer to chapter "Routine cleaning" in the "KION – Operating Manual" for details.

The internal battery, and the extra internal battery if fitted, shall be replaced every three years.

Some equipment used in the KION System but not covered by this Service Manual may also demand maintenance actions. Refer to the equipments documentation. These units can e. g. be:

- Multi-gas module
- KION Display including its optional equipment
- Suction equipment
- Auxiliary O_2 supply
- Gas evacuation
- Overflow screen
- Humidifier equipment
- Other optional equipment.

6

Handling PC boards

The PC boards contain components that are highly sensitive to static electricity.

Those who come into contact with circuit boards containing sensitive components must take certain precautions to avoid damaging the components (ESD protection).

When working with ESD sensitive components, always use a grounded wrist band and grounded work surface. Adequate service tools must also be used.

PC boards (spare parts) must always be kept in protective packaging for sensitive electronic devices.

PC boards must not be inserted or removed while mains power or battery power is applied to the PC boards.

Remove and insert the PC boards very carefully to avoid damage to the connectors.

Preparations

- Make sure that the KION System works properly before performing any maintenance.
- Set the power switch on the control panel to **Off**. If the power switch is set in any other position, the internal battery will supply power to the PC boards.
- Disconnect the mains power cable.
- Disconnect the gas supplies (wall and/or cylinder).
- Remove patient tubing (incl. gas sampling tube and water trap) and the manual breathing bag.
- If fitted, remove bacteria filter(s) from the patient cassette.

Equipment

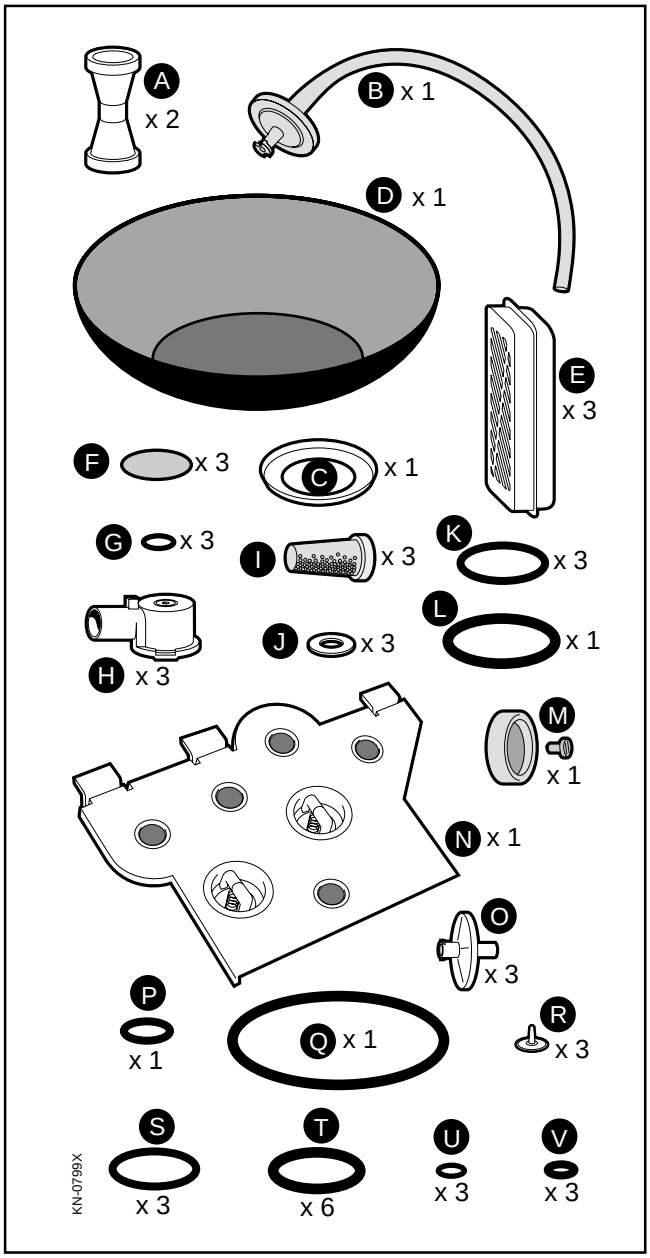
- Ordinary service tools.
- 24 mm socket wrench.
- Grease, Order No: 95 73 700 E341E. Special grease to be used in high O_2 concentrations.
- Loctite® 242.

Twelve months maintenance

Maintenance kits contents

When performing the "Twelve months maintenance", a "Maintenance kit 12 months for KION" should be used.

Only original parts from Siemens-Elema must be used in the KION System. Spare parts and maintenance kits can be ordered from your local Siemens representative.



The following parts shall be replaced and they are included in the "Maintenance kit 12 months for KION":

A. Fresh gas valve tube and expiratory valve tube.
B. Bacteria filter with tube for the PEEP pressure transducer.
C. Piston seal for the fresh gas pressure container.
D. Diaphragm for the fresh gas pressure container.
E. Bacteria filters for the gas modules.
F. Diaphragms for gas modules with metal nozzle unit.
G. O-rings 6.1 x 1.6 for gas modules with metal nozzle unit.
H. Plastic nozzle units. Will be included in the kit when gas modules of version B are introduced.
I. Gas inlet filters.
J. Gaskets for the gas inlet filters.
K. O-rings 15.3 x 2.4 for the gas distribution block.
L. O-ring 19.2 x 3 for the gas distribution block.
M. Expiratory flow transducer screen (mesh net) including screw.
N. Valve assembly plate for the patient cassette.
O. Bacteria filters for the silicone muff in the patient cassette docking station.
P. O-ring 9.3 x 2.4 for the vaporizer magazine.
Q. O-ring 36.2 x 3.0 for the vaporizer magazine.
R. One-way valves for the vaporizer magazine inlet connectors.
S. O-rings 14.1 x 1.6 for the vaporizer magazine inlet connectors.
T. O-rings 14 x 3 for the vaporizer magazine inlet and outlet connectors.
U. O-rings 5.1 x 1.6 for the vaporizer valve.
V. O-rings 5.3 x 2.4 for the vaporizer valve.

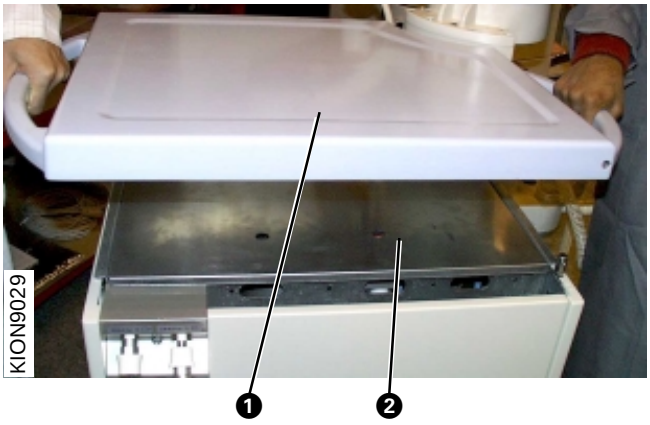
Backup gas supply manifold maintenance

If the KION System is equipped with a Backup gas supply manifold, a spare parts kit containing 4 gas inlet filters is required during the "Twelve months maintenance"

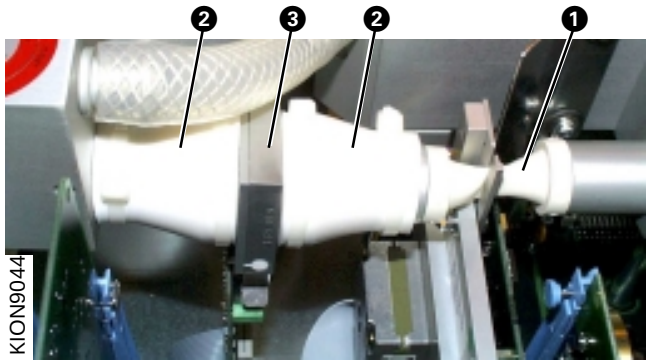
Performing the Twelve months maintenance

- Prepare the unit as described in section "Preparations" in this chapter.

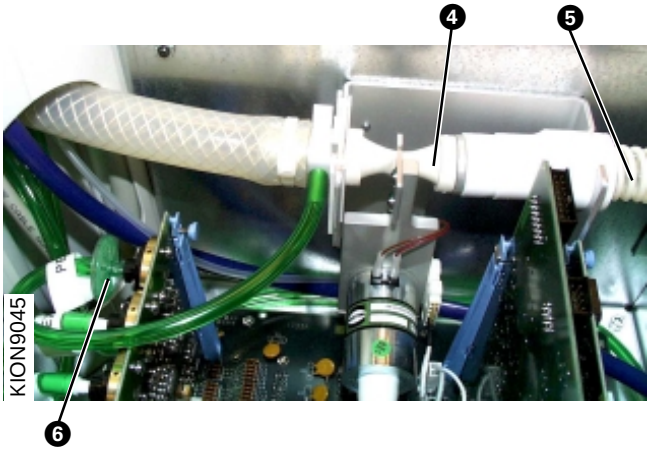
Pneumatic section



- Remove the screws holding the top cover (1). Lift off the cover. **Note**: The shelf in the cover can slide out if the cover is tilted.
- Lift off the shield cover (2).

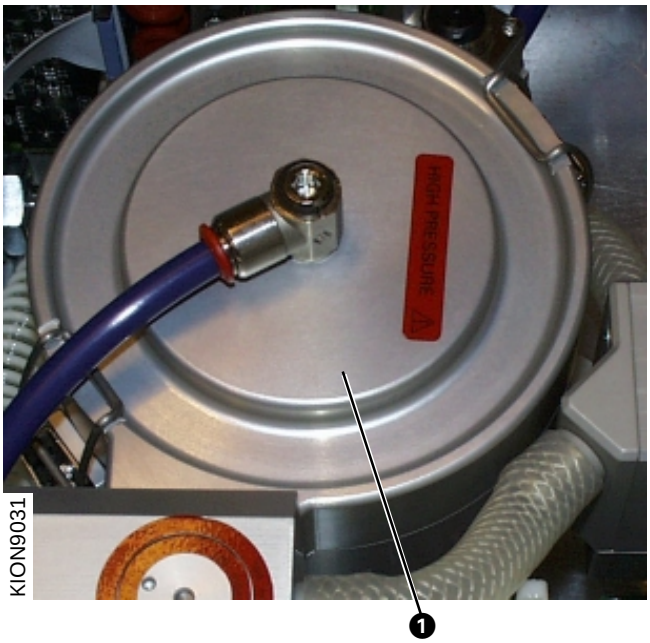


- Remove and disassemble the fresh gas channel:
  - Fresh gas valve tube (1). Discard the tube.
  - Silicone rubber connections (2).
  - Fresh gas flow transducer (3).
- Disconnect PC 1748 from the flow transducer (3).

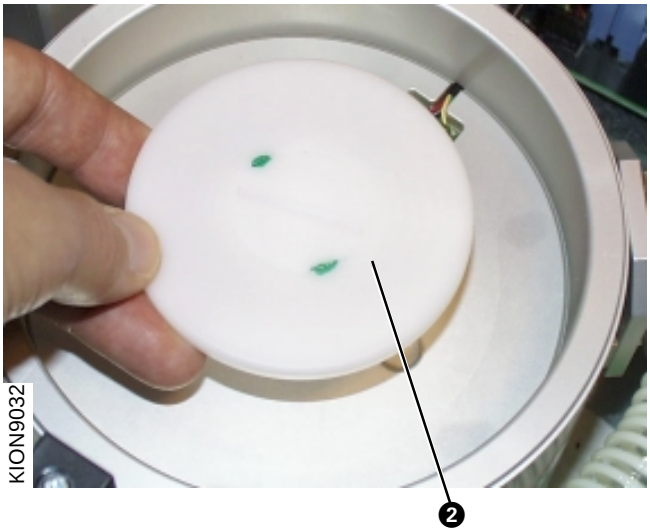


- Remove and disassemble the expiratory channel:
  - Expiratory valve tube (4). Discard the tube.
  - Hose (5)
- Remove and discard the bacteria filter with tube (6).
- Clean the flow transducer. Cleaning instructions for the flow transducer can be found in the "KION – Operating Manual", chapter "Routine cleaning".
- Clean the other parts, including the new valve tubes. Cleaning instructions can be found in the "KION – Operating Manual", chapter "Routine cleaning"
- Connect PC 1748 to the fresh gas flow transducer (3).
- Re-assemble the fresh gas channel and the expiratory channel.
- Reinsert the channels ensuring that the valve tubes (1) and (4) are not bent or twisted.
- Connect the new bacteria filter with tube (6).

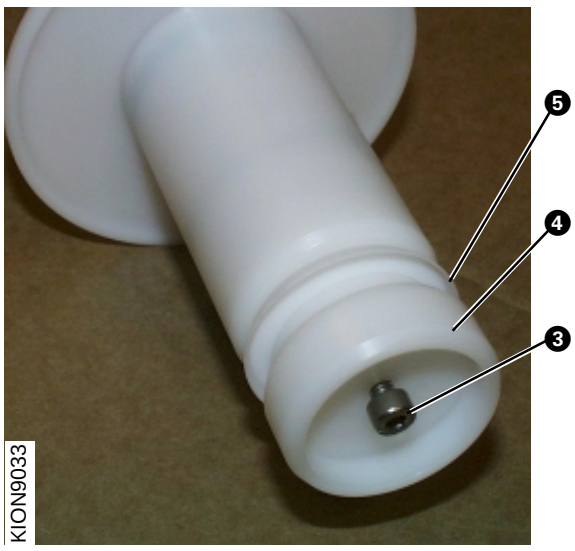
6



- Unclip and lift off the cover (1) of the fresh gas pressure container.

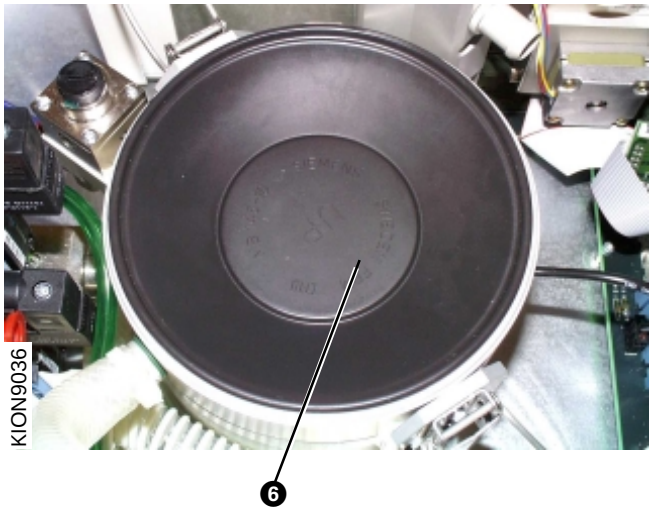


- Pull out the piston (2) from the pressure container.

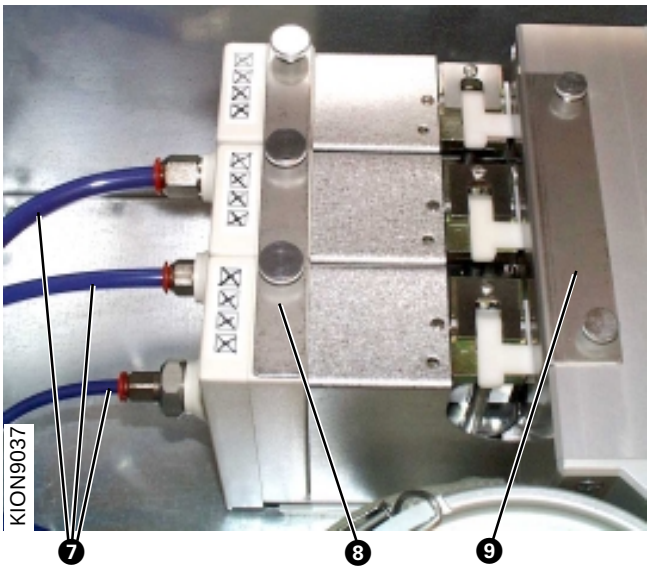


- Remove the screw (3) from the piston.
- Lift off the lower part (4) and the piston seal (5). Discard the old piston seal.
- Mount the new piston seal (5).
- Re-assemble the piston and carefully put the piston in position into the pressure container.

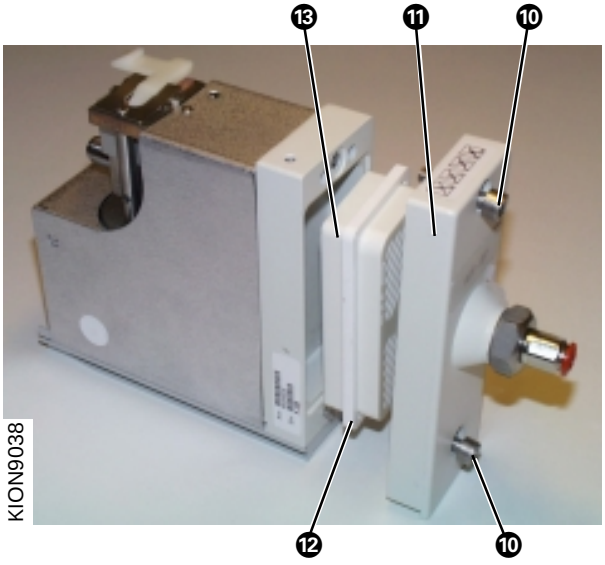
6



- Replace the diaphragm (6) in the pressure container. Discard the old diaphragm.
- Mount and secure the cover on the pressure container.

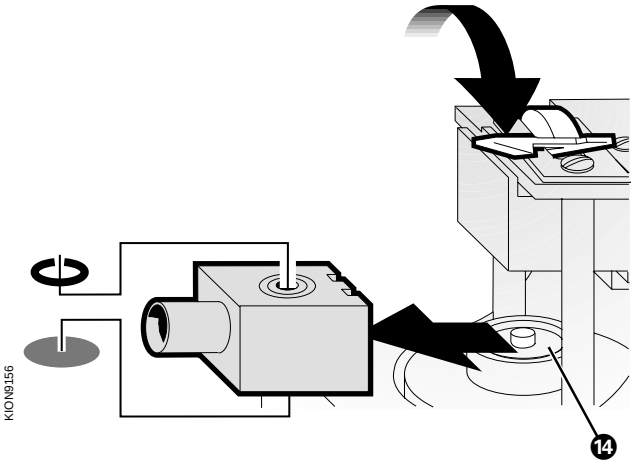


- Disconnect the tubes (7) from the three gas modules.
- Remove the locking rail (8).
- Remove the plate (9) and pull out the three gas modules.



On each one of the three gas modules:

- Unscrew the two screws (10) and lift off the cover (11).
- Remove the rubber sealing (12) from the old bacteria filter (13) and discard the old filter.
- Mount the rubber sealing on the new bacteria filter and put the new filter into the cover (11).
- Mount the cover on the gas module.

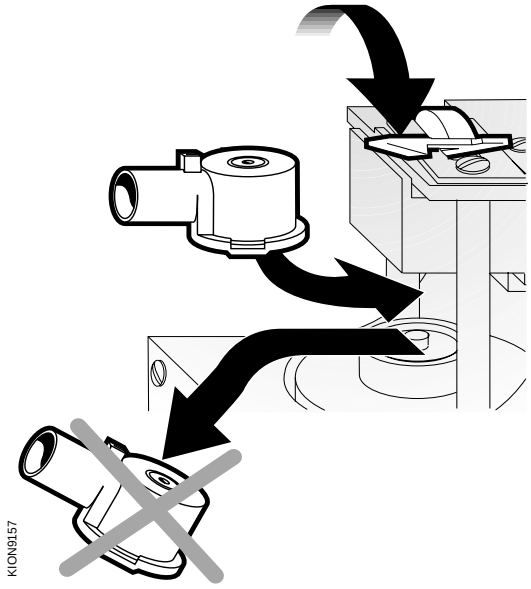


Gas modules with <u>metal</u> nozzle unit:

- Open the hatch and pull out the nozzle unit.
- Replace the O-ring 6.1 x 1.6 and the diaphragm.

Do not use any sharp tools that may damage the valve seat.

- On the AIR – BP and O_2 – BP gas modules, make sure that the washer (14) is placed in position. This washer is not used in the AIR/LUFT gas module.
- Put the nozzle unit back and close the hatch.
- Discard the old O-ring and diaphragm.



Gas modules with <u>plastic</u> nozzle unit:

- Open the hatch and pull out the nozzle unit.
- Put the new plastic nozzle unit in position into the gas module and close the hatch.
  The maintenance kit contains two nozzle units (adapted for back pressure) to be mounted in the AIR – BP and O_2 – BP gas modules and one nozzle unit to be mounted in the AIR/LUFT gas module.
- Discard the old nozzle unit.

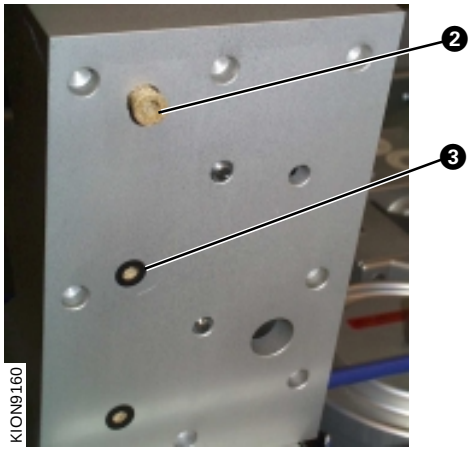
6

The nozzle units are provided with a mechanical key to prevent that the nozzle unit is mounted into wrong gas module.

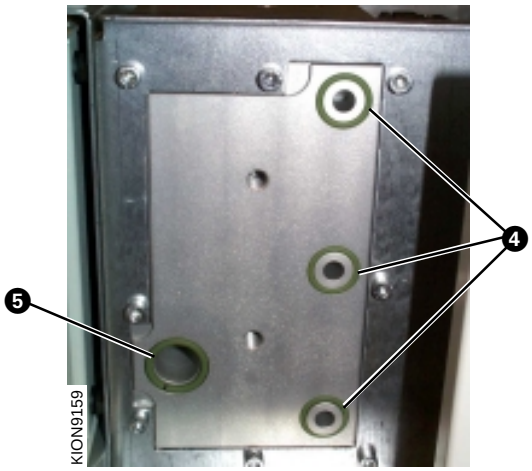
- Put the gas modules back, secure them with the locking rail (8), the plate (9) and connect the gas tubes (7).

Wait 10 minutes before connecting pressure to the gas modules.

- Remove the two screws (1) and lift off the gas connection housing from the gas distribution block.



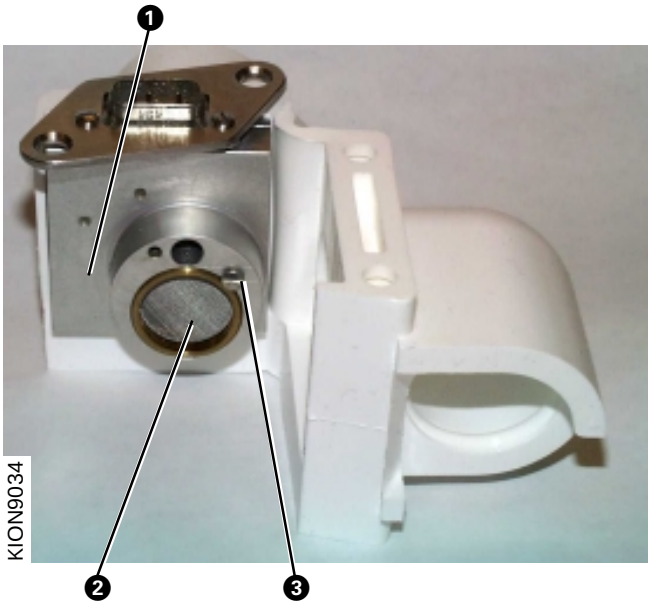
- Replace the gas inlet filter (2) and the gasket (3) in all three gas inlets.



- Replace the O-rings 15.3 x 2.4 (4).
- Replace the O-ring 19.2 x 3 (5).

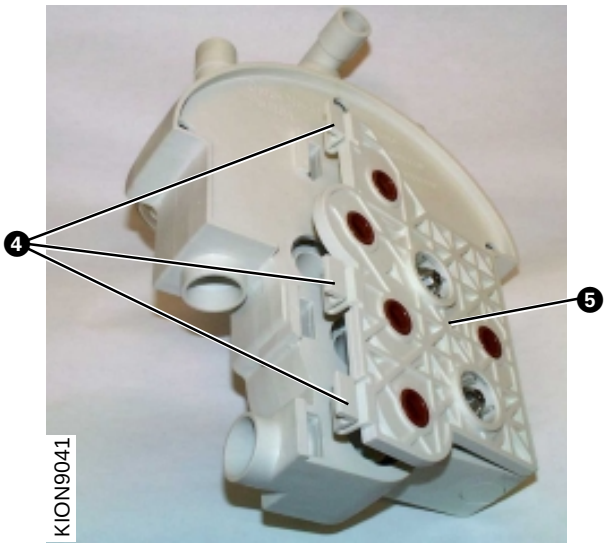
- Reassemble the gas distribution block.

- Mount the shield cover (2) and the top cover (1) on the pneumatic section.



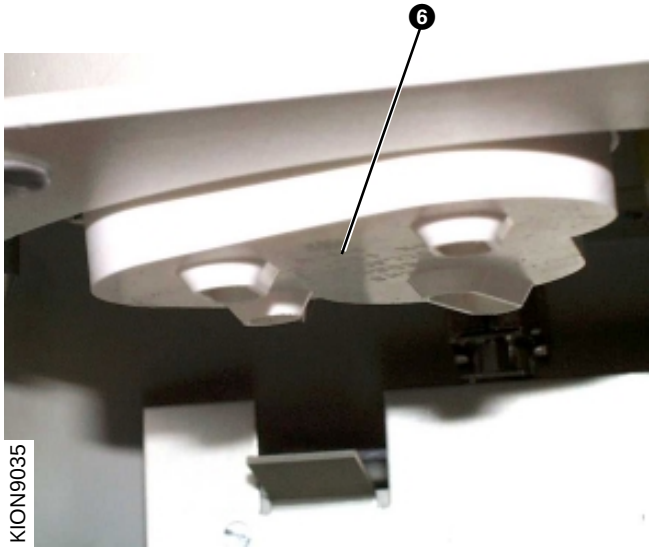
Patient unit

- Remove the patient cassette.
- Remove the expiratory flow transducer (1) from the silicone muff.
- Replace the mesh net (2) and the screw (3). Discard the old mesh net and screw.
- Clean the flow transducer. Cleaning instructions for the flow transducer can be found in the "KION – Operating Manual", chapter "Routine cleaning".

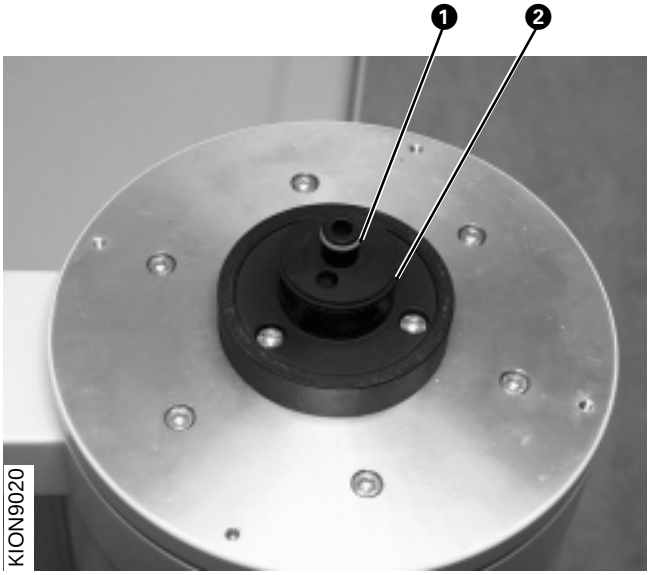


- Release the three latches (4) holding the valve assembly plate (5).
- Lift off and discard the old valve assembly plate (5).
- Remove (pull down) the silicone muff (6) from the cassette docking station.
- Remove and discard the three old bacteria filters in the silicone muff.

- Clean the patient cassette (including the new valve assembly plate) and the silicone muff (6). Cleaning instructions can be found in the "KION – Operating Manual", chapter "Routine cleaning". The silicone muff (6) can be autoclaved at max. 134°C (273°F).

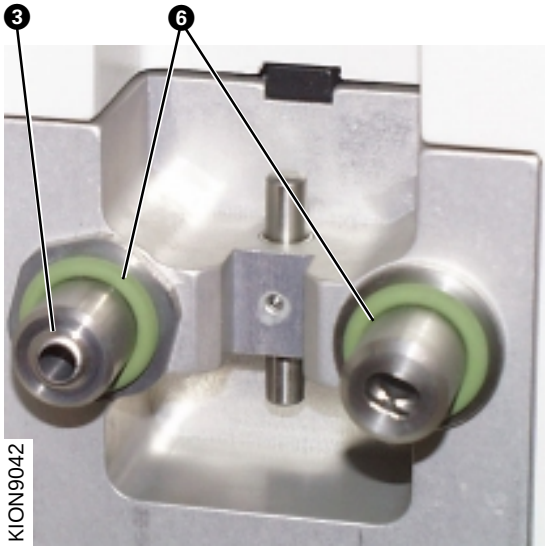


- Mount the new valve assembly plate (5) and make sure that the latches snap into position.
- Re-assemble the patient cassette.
- Insert three new bacteria filters in the silicone muff.
- Mount the silicone muff (6) into the cassette docking station.
- Mount the patient cassette into the docking station.



Vaporizer magazine

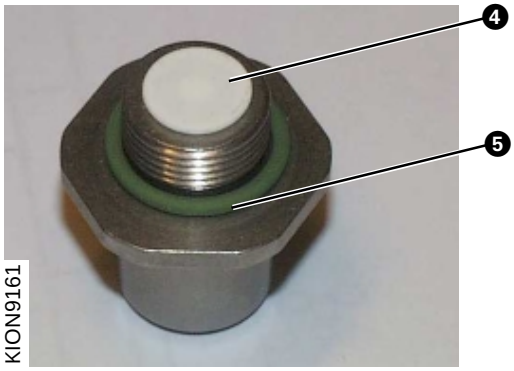
- Remove the vaporizer cover and the vaporizer magazine as described in chapter 3 ”Disassembling and assembling”, section ”Vaporizer magazine”.
- Replace the O-ring 9.3 x 2.4 (1) and the O-ring 36.2 x 3.0 (2). Discard the old O-ring.
- Apply a thin layer of special grease on the O-rings.
- Reassemble the vaporizer magazine.

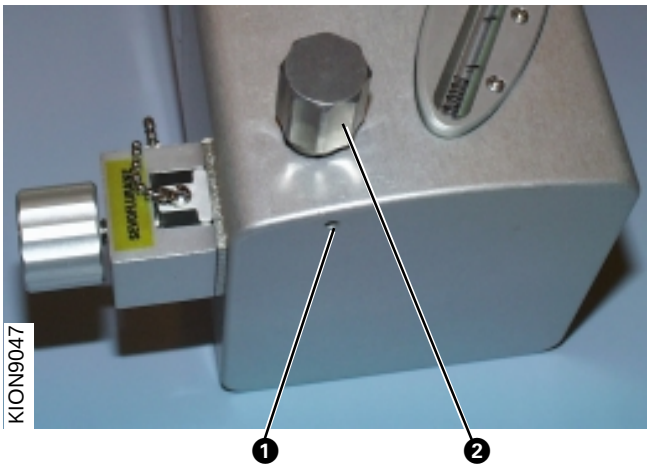


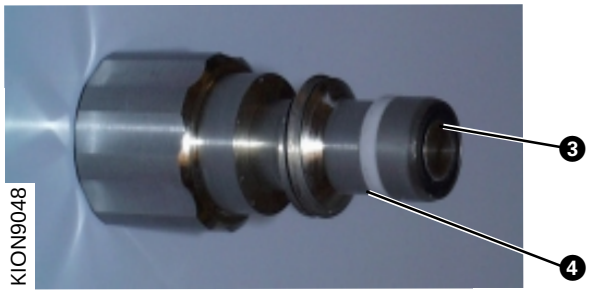
- Remove the three vaporizer magazine inlet connectors (3) using the 24 mm socket wrench.
- Carefully replace the one-way valves (4). Discard the old one-way valves.

Do not use any sharp tools that may damage the one-way valves.

- Replace the O-rings 14.1 x 1.6 (5) on the inlet connectors. Discard the old O-rings.
- Mount the vaporizer inlet connectors (3) onto the vaporizer magazine.
- Replace the O-rings 14 x 3 (6) on the inlet and outlet connectors. Discard the old O-rings.

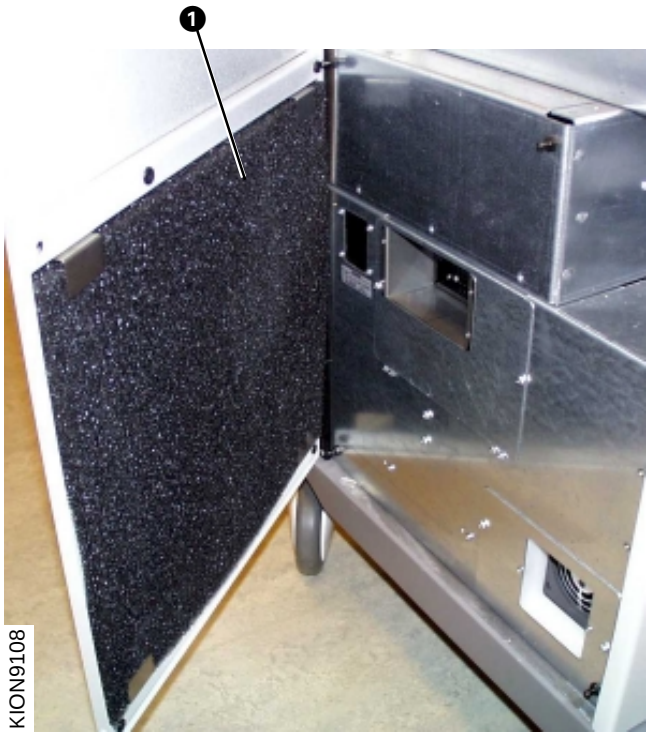






PIVap vaporizers

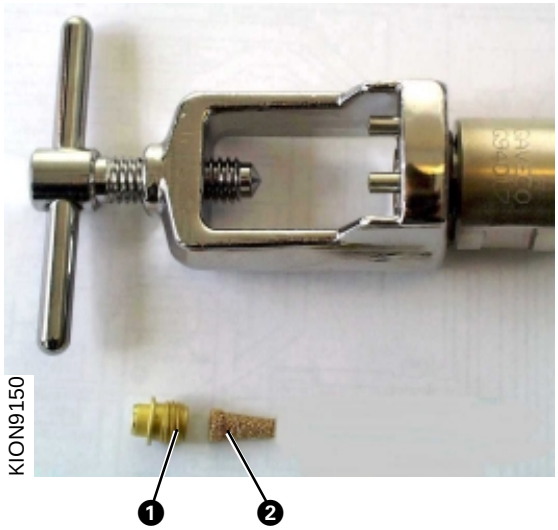
- On each one of the vaporizers to be used in the KION System:
  - Empty the vaporizer.
  - Remove the screw (1). **Note**: The screw is sealed with Loctite.
  - Remove the knob (2).
  - Replace the O-ring 5.1 x 1.6 (3) and the O-ring 5.3 x 2.4 (4). Discard the old O-rings.
  - Apply a thin layer of special grease on the O-rings.
  - Remount the knob (2).
  - Apply Loctite® 242 on the screw (1).
  - Remount the screw (1). **Note**: Do not tighten the screw to hard, the knob (2) must be easy to turn.



Dust filter

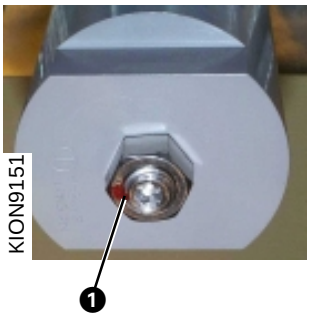
- Check the dust filter (1) inside the trolley cover.
- Clean the dust filter if it is clogged. The dust filter can be rinsed in water. Shake out all remaining water. Make sure that no water remains in the filter.

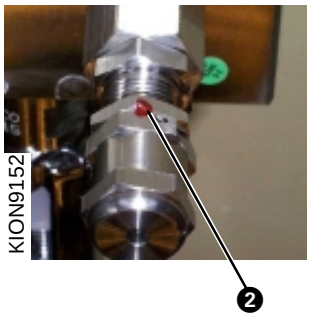
6



Backup Gas Supply Manifold

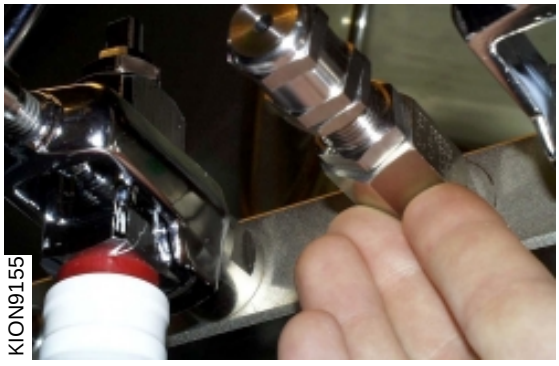
- Replace the gas inlet filter in all four yokes:
  - Remove the filter holder (1) mounted in the gas inlet channel inside the yoke. To remove the filter holder, use a 5/32" (4 mm) hexagonal wrench.
  - Replace the filter (2). Discard the old filter.
  - Reassemble the yoke.



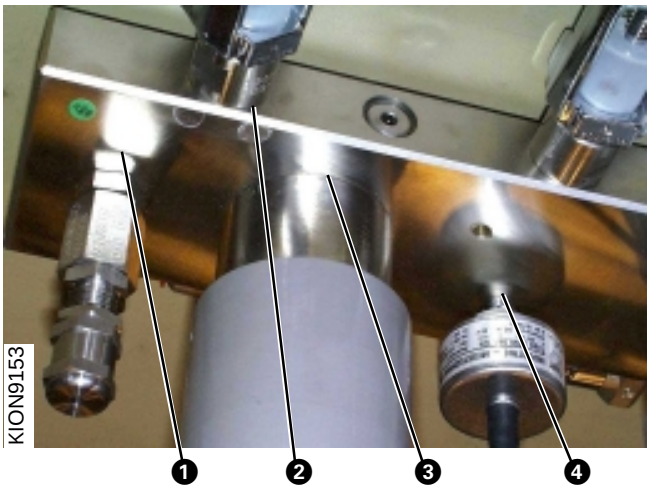


- The pressure regulators and the safety valves are preset to correct settings and secured with a visible drop of sealant. Inspect the pressure regulators and the safety valves:
  - Check that the seals (1) on the pressure regulators are not broken.
  - Check that the seals (2) on the safety valves are not broken.
- If a seal on any of these units is broken, replace this unit (see chapter 3. Disassembling and assembling).

- Connect gas supply (from the hospital central gas supply) to all three gas inlets on the KION System.
- Check if there is a leakage through the one-way valves (OV5 – OV8) in all four yokes. Cover the gas inlet channel in each yoke with a finger and check if there is a pressure built-up under the finger. Replace faulty one-way valves if necessary (see chapter 3. Disassembling and assembling).
- Disconnect the gas supply.



- Connect gas cylinders to the backup gas supply manifold and open the cylinder valves.
- Check if there is a leakage through the safety valves (SV5 – SV7). Cover both outlet holes on each one of the safety valves with two fingers and check if there is a pressure built-up under the fingers. Replace faulty safety valves if necessary (see chapter 3. Disassembling and assembling).



- Check for gas leakages (with gas cylinder valves still open). Use leakage detection spray/liquid and check the following connections:
  - The connection between the safety valves and the manifold (1).
  - The connection between the yoke and the manifold (2).
  - The connection between the pressure regulators and the manifold (3).
  - The connection between the pressure transducer and the manifold (4).
- Close the gas cylinder valves.
- If a gas leakage was detected, replace the O-ring/ gasket at the faulty unit (see chapter 3. Disassembling and assembling) and re-check.

A function check of the Backup Gas Supply Manifold will be performed as a part of section "Completing the Twelve months maintenance" below.

- With gas cylinder valves still open, check for gas leakages through the gas connections on the gas distribution block. Cover the gas inlet with a finger and check if there is a pressure built-up under the finger. If necessary, replace faulty one-way valves inside the gas distribution block. These one-way valves (OV1 – OV3) are accessible when the gas connection housing is removed from the gas distribution block as described in this chapter, section "gas inlet filter replacement".

6

Checking the internal battery

- Allow the internal battery to charge until the battery indicator on the KION Display shows "**100%**".
- Disconnect mains power to make the KION System run on the internal battery.
- Let the KION System run on the internal battery and check the battery alarm is not activated within:
  - 40 minutes if the KION System is equipped with standard internal battery.
  - 130 minutes if the KION System is equipped with extra internal battery.
- Allow the internal battery to recharge before clinical use of the KION System.

Note: To save time, this battery test can be performed during the functional checks described below in section "Completing the Twelve months maintenance".

Safety inspection

- Make a visual inspection of the KION System for external defects or damages.
- Check the mains power cable, voltage supply cables and connections for damage.
- Perform a leakage current test. The leakage current test is a standard procedure regulated by IEC 60 601-1 or corresponding national standards. Allowable values and test methods are defined in the standard. The use of a leakage tester, e. g. Bender Safety Tester 601/751 or equivalent is recommended.
- Check that a "KION – Operating Manual" corresponding to the installed software version is present. Also check that Operating Manuals for all optional equipment connected to the KION System are present.

Completing the Twelve months maintenance

- Perform a check of all vaporizers to be used in the KION System. For details, refer to the "KION – Operating Manual", section "Checking the vaporizers (PIVap™)" in the "Six month maintenance"-chapter.
- Perform a "Functional check". Refer to the "KION – Operating Manual" for details.
- Perform a "Calibration". Refer to the "KION – Operating Manual" for details.
- Perform "Functional checks" on the optional equipments connected to the KION System. Refer to the Operating Manual for these equipments (Backup gas supply manifold, Auxiliary O_2 supply, Suction equipment, etc).
- Note in the KION Systems log book that a "Twelve months maintenance" has been performed.

Replacing the internal battery

Tested batteries

Tested batteries for use in KION are:

- HITACHI HP24-12
- VARTA, Type accu-CF
- NEWMAX, Type FNC 12240
- CSB, Type EVX-12260.

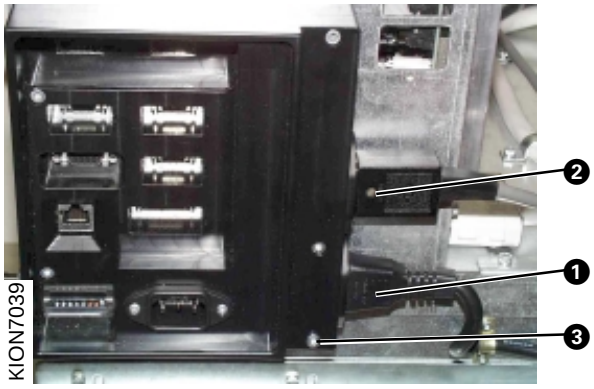
No other batteries must be used.

> Replace all internal batteries at the same time, the two standard internal batteries as well as the two extra internal batteries if fitted (optional).
>
> After battery installation or replacement, allow the batteries to recharge before clinical use of the KION System.

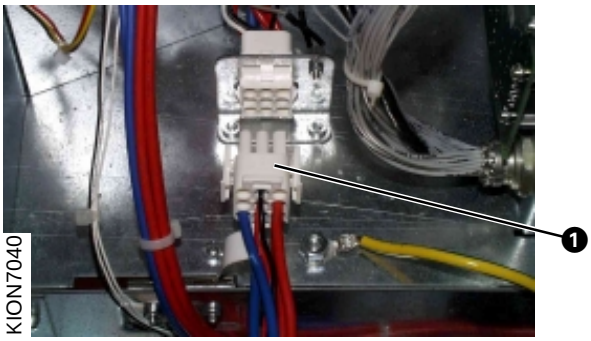
Performing the battery replacement

- Prepare the unit as described in section "Preparations" in this chapter.

- Remove the trolley cover from the battery drawer.
- Remove the screws (1), disconnect the cable (2) and pull out the battery drawer (3).

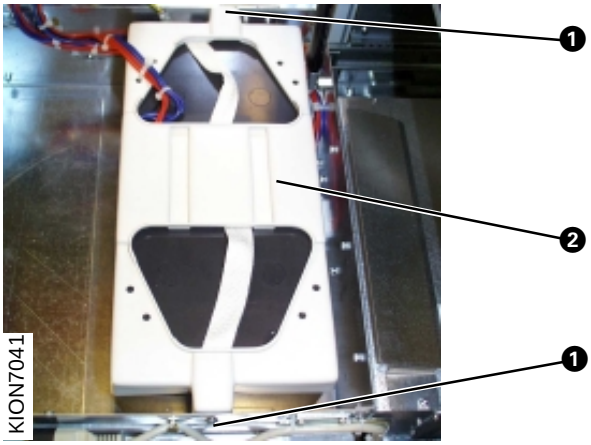


- Disconnect the AC/DC Converter cable (1).
- Disconnect the Isolation transformer cable (2) if fitted (optional).
- Remove the screw (3) and open the Power and communication interface.

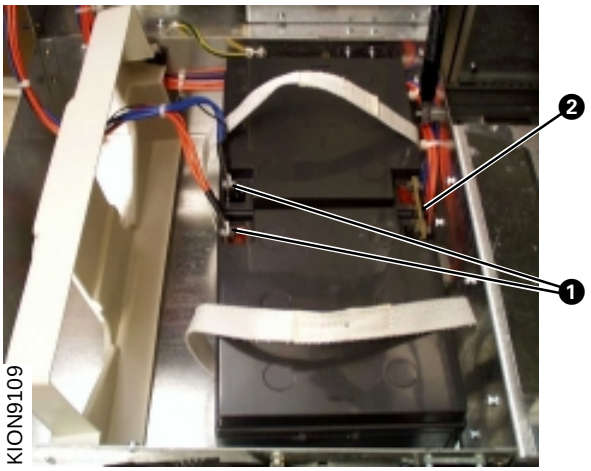


- Disconnect the battery cable (1).

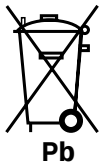
> Always keep the battery cable disconnected when working inside the Power & Communications Interface.
>
> When removing or installing batteries, be very careful with service tools, connection cables, etc, in order not to short-circuit the batteries.



- Remove the two screws (1) securing the battery holder.
- Lift off the battery holder (2)



- Disconnect the battery cable (1) and the pole connection bar (2) from the batteries.
- Lift off and discard the old batteries. Worn-out batteries must be returned to the place of purchase or to a place where they can be safely disposed of. Batteries must not be disposed of with ordinary waste.



- If the KION System is equipped with extra internal battery (optional), also remove and discard these batteries as described above.

- Mount the new batteries into the battery drawer. The procedure is the reverse of the procedure for removing the batteries as previously performed.

6

Checking the internal battery

- Allow the internal battery to charge until the battery indicator on the KION Display shows "**100%**". This charging time must not be longer than 12 hours.
- Run the KION System on the internal battery (with mains power disconnected) until the alarm "**No Battery Capacity Left**" is activated. This event is logged in the Diagnostic Log. There is no need to supervise the KION System during the test.
- Verify the condition of the battery by checking the Diagnostic Log. The time between the alarm **"Disconnect"** and the alarm "**Limited Battery Capacity Left**" must be at least 40 min or 130 min if the KION System is equipped with Extra internal battery (optional). Also check that the time between the alarm "**Limited Battery Capacity Left**" and the alarm "**No Battery Capacity Left**" is approx. 10 min.
- Allow the internal battery to charge until the battery indicator on the KION Display shows "**100%**". This charging time must not be longer than 12 hours. If "**100%**" is not reached within 12 hours, the battery does not work properly and must be replaced.

Completing the battery replacement

- Perform a "Functional check" of the KION System according to instructions in the "KION - Operating Manual".

Notes

7. Installation of optional equipment

Accessory shelf ..... 7 - 2
Monitor shelf ..... 7 - 6
Overflow screen (DUOVIEW) ..... 7 - 10
Multi-gas module ..... 7 - 12
Extra internal battery ..... 7 - 16
Isolation transformer ..... 7 - 20
Backup gas supply manifold ..... 7 - 23
Suction equipment ..... 7 - 27
Auxiliary O_2 supply (Flowmeter O_2) ..... 7 - 31
Gas evacuation ..... 7 - 35

Accessory shelf

General

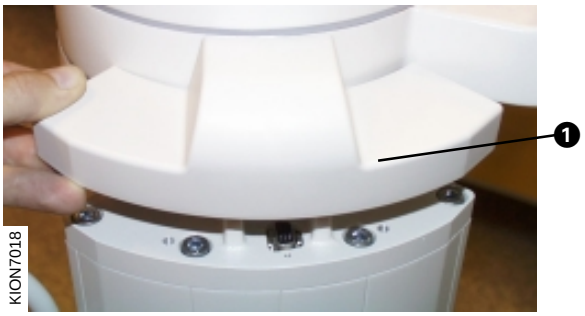
An optional accessory shelf can be mounted on the KION System. It is not possible to mount the accessory shelf if the KION System is already equipped with a monitor shelf.

KION7022

Only personnel authorized by Siemens shall be permitted to install, service or repair the KION System.

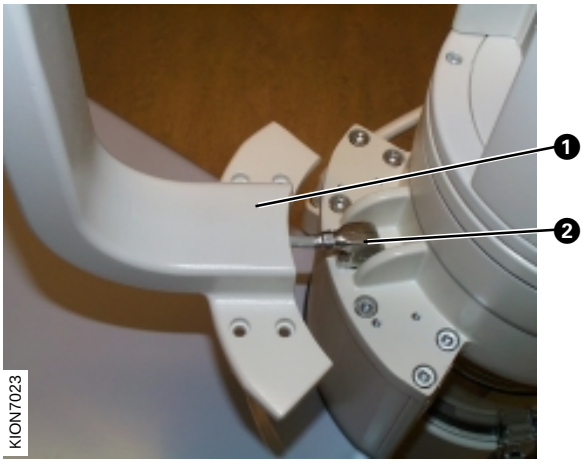
Installation instructions

- Set the power switch on the control panel to **Off**.
- Disconnect the mains power cable.
- Disconnect the gas supplies (wall and tank).



KION7018

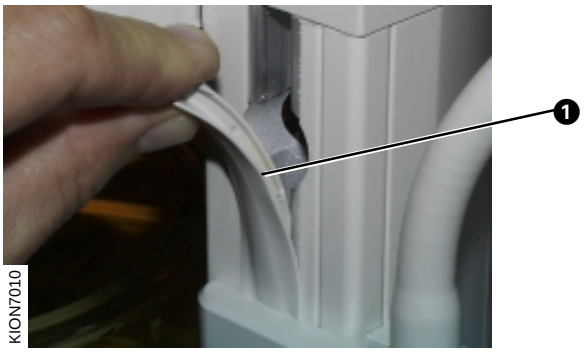
- If the KION system is not equipped with an Overflow Screen (DuoView):
  - Remove the plastic cover (1) from the column.



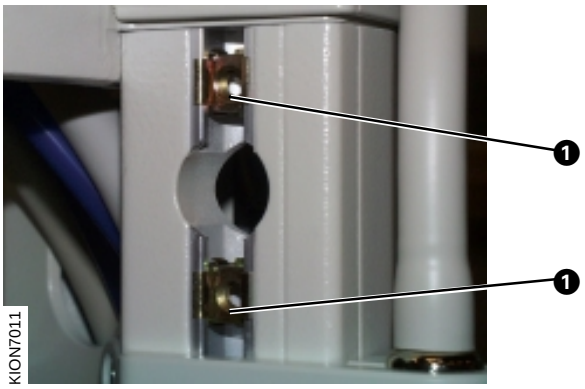
KION7023

- If the KION system is equipped with an Overflow Screen (DuoView):
  - Remove the screen arm (1) from the column and disconnect the overflow screen cable (2).

7



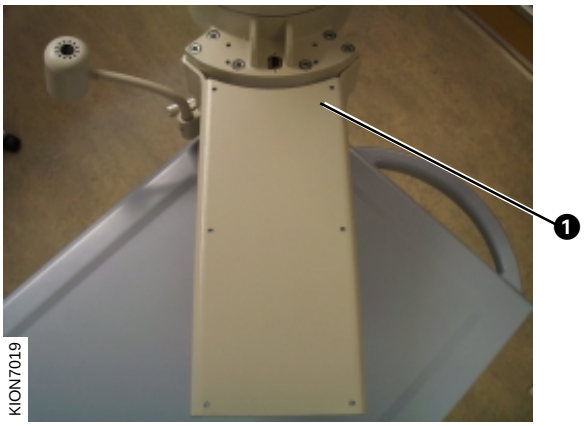
- If the KION System is not equipped with an Auxiliary O_2 Supply (Auxiliary O_2 Flowmeter):
  - Remove the plastic strip (1) covering the accessory mounting rail. Remove the plastic strip from the mounting rails on both sides of the column.



  - If necessary, insert nuts (1) into the accessory mounting rails. Four nuts are required for the accessory shelf, two on each side of the column.

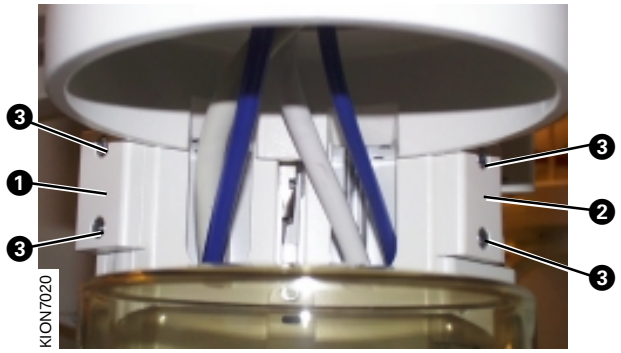
- If the KION System is equipped with an Auxiliary O_2 Supply (Auxiliary O_2 Flowmeter):
  - Remove the flowmeter (1).
  - Disconnect the O_2 tube (2) from the flowmeter.
  - Remove the flowmeter holder (3).

  Detailed instructions can be found in the ”Auxiliary O_2 Supply” section.

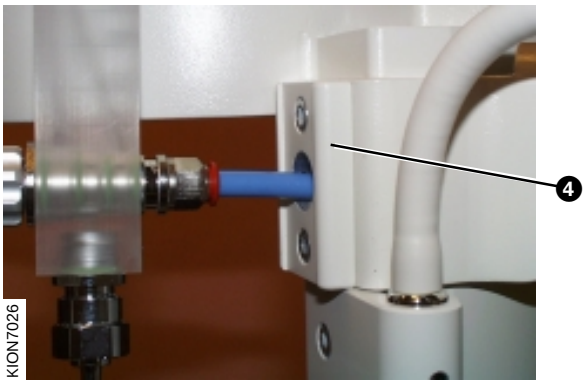


- Put the shelf bracket (1) in position onto the column.

7



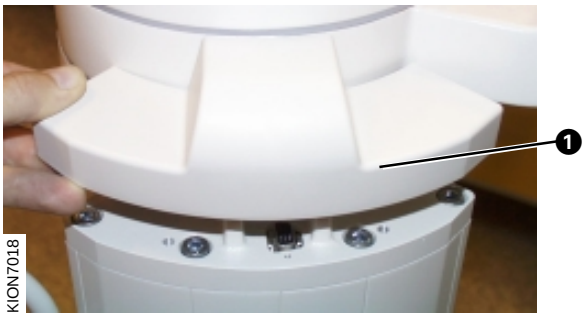
- If the KION System is not equipped with an Auxiliary O_2 Flowmeter:
  - Mount the shelf bracket using the two mounting plates (1 and 2) and the four screws (3) included in the delivery.



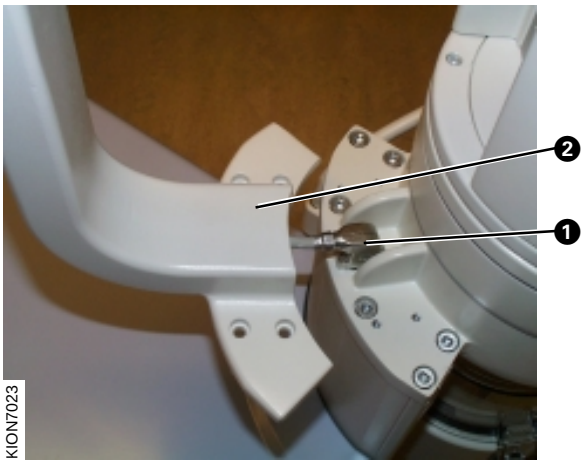
- If the KION System is equipped with an Auxiliary O_2 Flowmeter:
  - Mount the shelf bracket using mounting plate (1), flowmeter holder (4) and the four screws (3) included in the delivery. See illustration above. Mounting plate (2) is not used
  - Connect the O_2 tube and re-mount the flowmeter. Detailed instructions can be found in the ”Auxiliary O_2 Supply” section.

- Mount the accessory shelf onto the shelf bracket using the six screws (1) included in the delivery.

7



- If the KION System is not equipped with an Overflow Screen (DuoView):
  - Mount the plastic cover (1) on the column.



- If the KION system is equipped with an Overflow Screen (DuoView):
  - Connect the overflow screen cable (1) and re-mount the screen arm (2) to the column.

- If the Auxiliary O_2 Flowmeter has been removed during installation of the Accessory shelf; perform a "Function check" of the flowmeter according to instructions in the "KION Auxiliary Oxygen Flowmeter – Operating Manual".

7

Monitor shelf

General

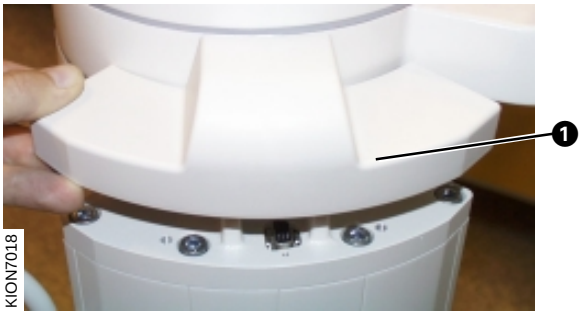
An optional monitor shelf can be mounted on the KION System. It is not possible to mount the monitor shelf if the KION System is already equipped with an accessory shelf.

KION7024

Only personnel authorized by Siemens shall be permitted to install, service or repair the KION System.

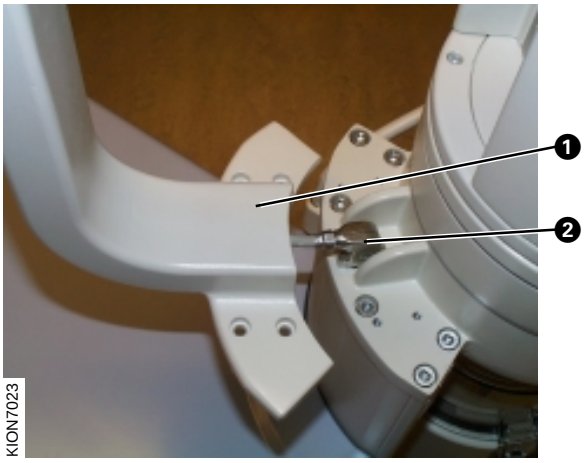
Installation instructions

- Set the power switch on the control panel to **Off**.
- Disconnect the mains power cable.
- Disconnect the gas supplies (wall and tank).



KION7018

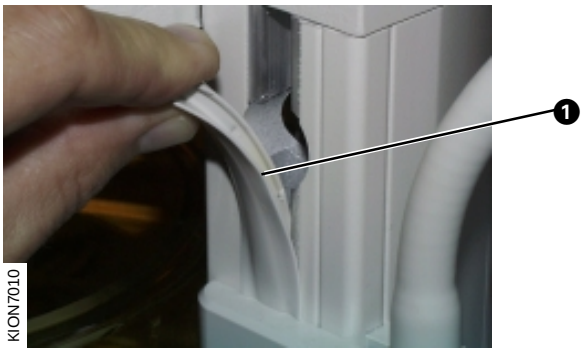
- If the KION System is not equipped with an Overflow Screen (DuoView):
  - Remove the plastic cover (1) from the column.



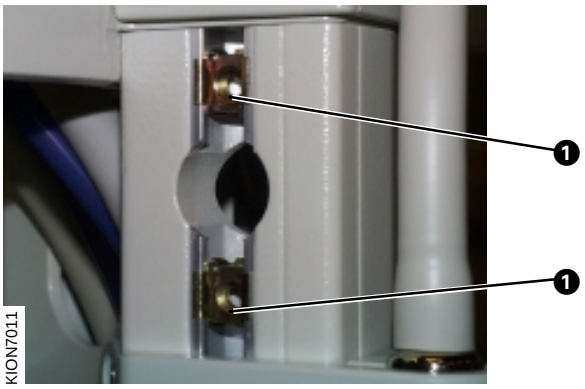
KION7023

- If the KION System is equipped with an Overflow Screen (DuoView):
  - Remove the screen arm (1) from the column and disconnect the overflow screen cable (2).

7



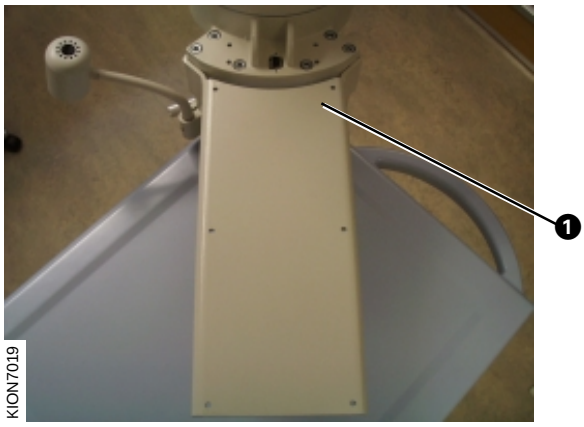
- If the KION System is not equipped with an Auxiliary O_2 Supply (Auxiliary O_2 Flowmeter):
  - Remove the plastic strip (1) covering the accessory mounting rail. Remove the plastic strip from the mounting rails on both sides of the column.



  - If necessary, insert nuts (1) into the accessory mounting rails. Four nuts are required for the accessory shelf, two on each side of the column.

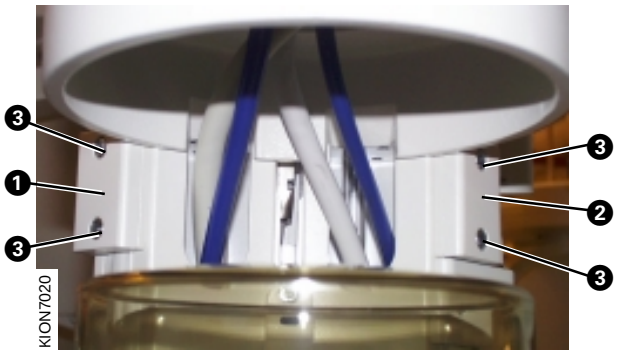
- If the KION System is equipped with an Auxiliary O_2 Supply (Auxiliary O_2 Flowmeter):
  - Remove the flowmeter (1).
  - Disconnect the O_2 tube (2) from the flowmeter.
  - Remove the flowmeter holder (3).

  Detailed instructions can be found in the ”Auxiliary O_2 Supply” section.

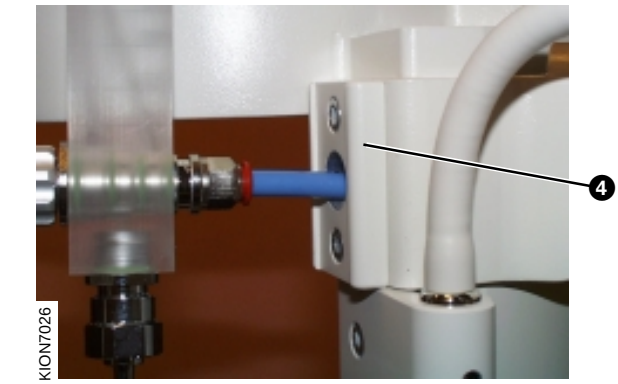


- Put the shelf bracket (1) in position onto the column.

7

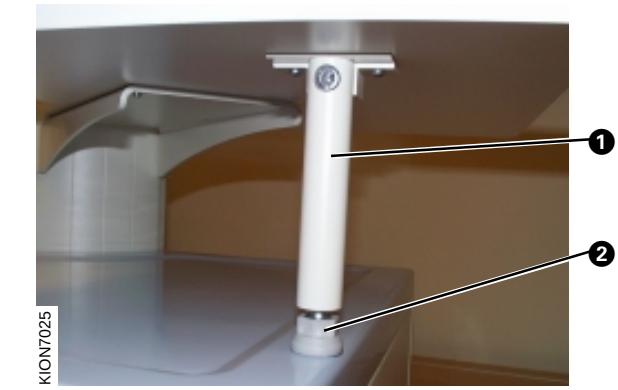


- If the KION System is not equipped with an Auxiliary O_2 Flowmeter:
  - Mount the shelf bracket using the two mounting plates (1 and 2) and the four screws (3) included in the delivery.



- If the KION System is equipped with an Auxiliary O_2 Flowmeter:
  - Mount the shelf bracket using mounting plate (1), flowmeter holder (4) and the four screws (3) included in the delivery. See illustration above. Mounting plate (2) is not used
  - Connect the O_2 tube and re-mount the flowmeter. Detailed instructions can be found in the "Auxiliary O_2 Supply" section.

- Mount the accessory shelf onto the shelf bracket using the six screws (1) included in the delivery.



- Mount the monitor shelf support leg (1) on the monitor shelf using the screw included in the delivery.
- If necessary, adjust the hight of the support leg by turning the foot (2).

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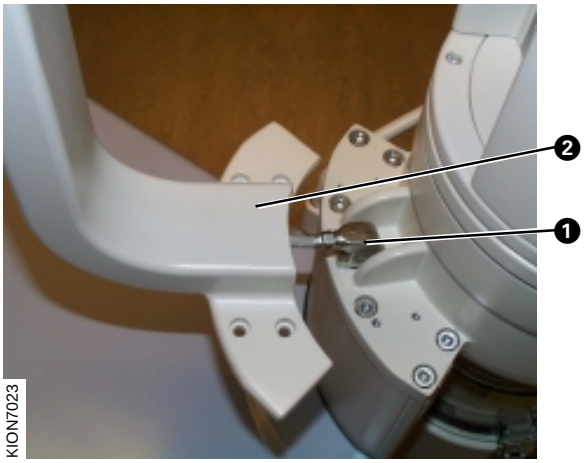
- If the KION System is not equipped with an Overflow Screen (DuoView):
  - Mount the plastic cover (1) on the column.



- If the KION System is equipped with an Overflow Screen (DuoView):
  - Connect the overflow screen cable (1) and re-mount the screen arm (2) to the column.

- If the Auxiliary O_2 Flowmeter has been removed during installation of the monitor shelf; perform a "Function check" of the flowmeter according to instructions in the "KION Auxiliary Oxygen Flowmeter – Operating Manual".

7

Overflow screen

General

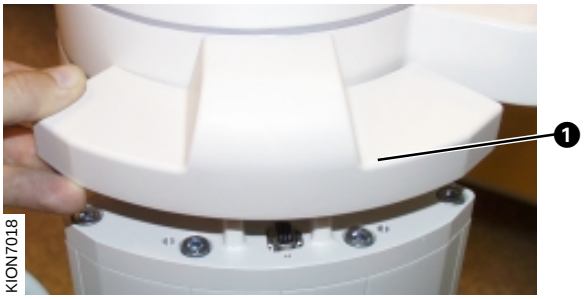
For additional monitoring capabilities, an Overflow screen (DUOVIEW) can be connected to KION System.

> Only personnel authorized by Siemens shall be permitted to install, service or repair the KION System.

KION7027

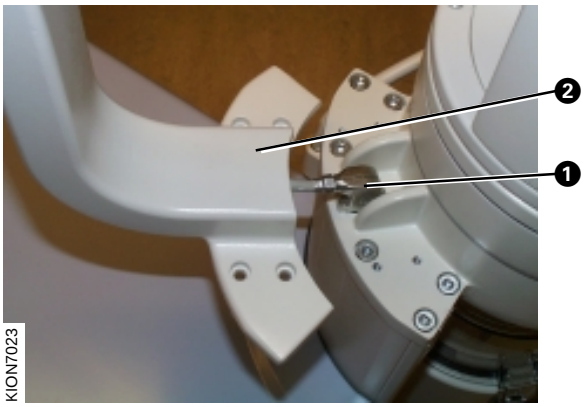
Installation instructions

- Set the power switch on the control panel to **Off**.
- Disconnect the mains power cable.
- Disconnect the gas supplies (wall and tank).



KION7018

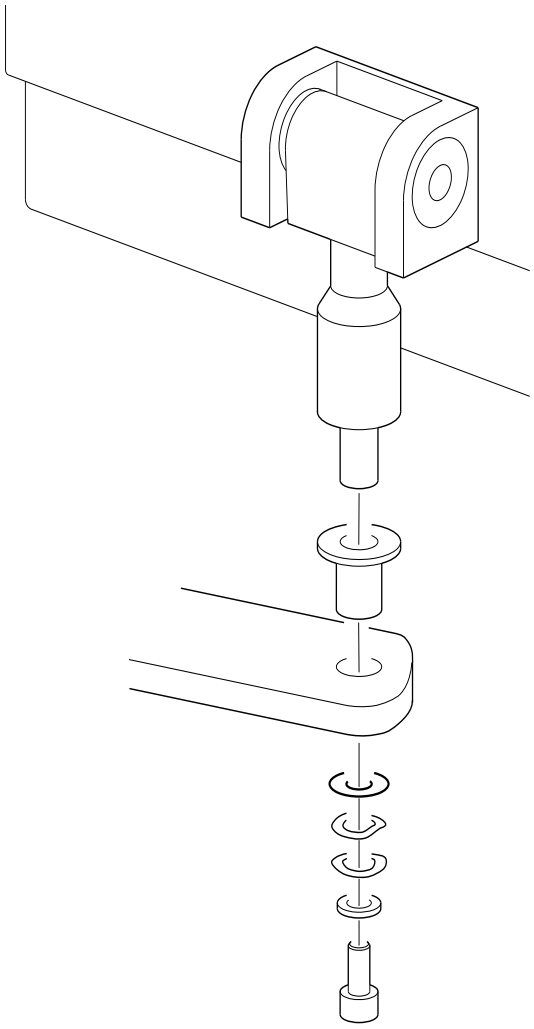
- Remove the plastic cover (1) from the column.



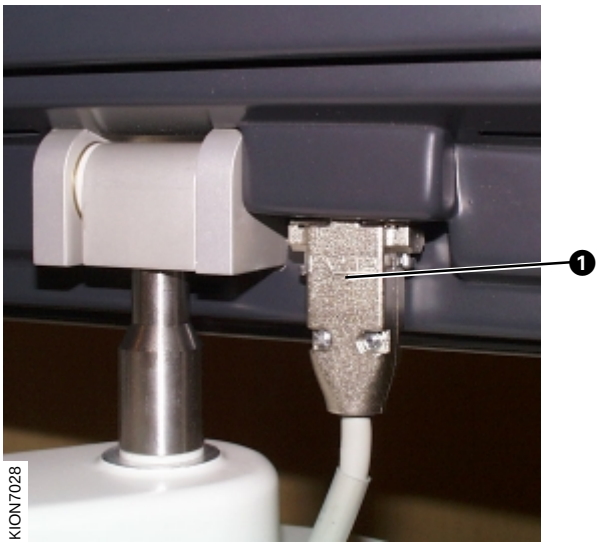
KION7023

- Connect the overflow screen cable (1) and mount the screen arm (2) to the column. Use the screws included in the delivery.

7


KN-S701X

- Mount the DUOVIEW screen on the screen arm. Make sure that all washers are mounted as indicated in the illustration. Apply Loctite®242 on the screw.



- Connect the overflow screen cable (1) to the DUOVIEW connector.

The DUOVIEW is power supplied from KION and will automatically start when the KION power switch is turned from **Off** to **Standby** or **On**. During the DUOVIEW start-up sequence, communication with KION Display (SC 7000/SC 9000) will be established and start-up information will be displayed on the DUOVIEW.

The DUOVIEW is controlled by the KION Display and any parameter settings on the DUOVIEW are made on the KION Display as described in the SC 7000/SC 9000 User's Guide. The knob on the DUOVIEW sets the brightness on the screen.

The DUOVIEW will be shut off when the KION power switch is set to **Off**.

7

Multi-gas module

General

As an option, a multi-gas module can be installed into the KION System. The module to be installed is a modified version of the stand-alone MULTIGAS+™ module.

With a MULTIGAS module (MGM) installed, the concentration of the following gases can be displayed on the KION Display:

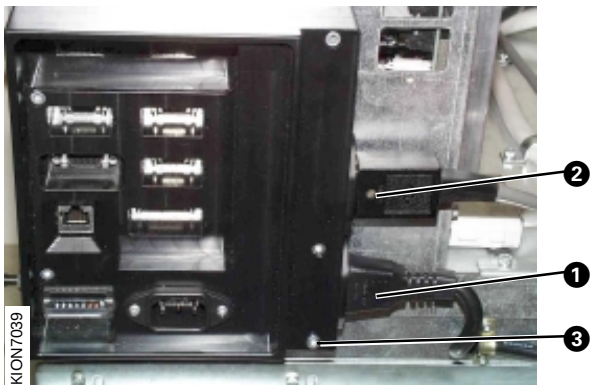
- O_2 (measured by a fast-acting paramagnetic sensor)
- CO_2
- N_2O
- Anesthetic agent.

Only personnel authorized by Siemens shall be permitted to install, service or repair the KION System.

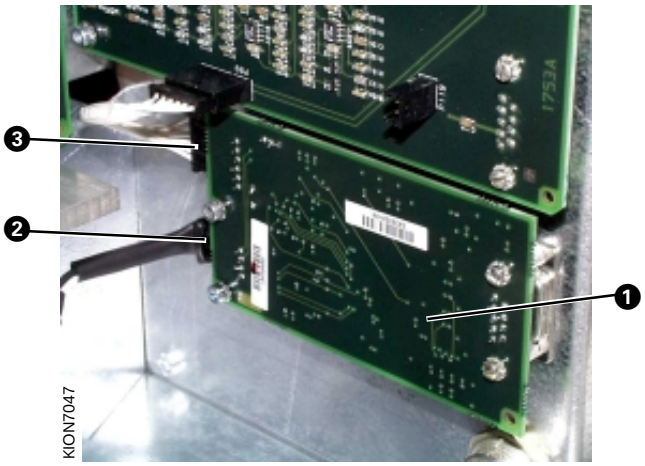
Installation instructions

- Set the power switch on the control panel to **Off**.
- Disconnect the mains power cable.
- Disconnect the gas supplies (wall and tank).

- Remove the lower trolley covers.
- Remove the screws (1), disconnect the cable (2) and pull out the battery drawer (3).

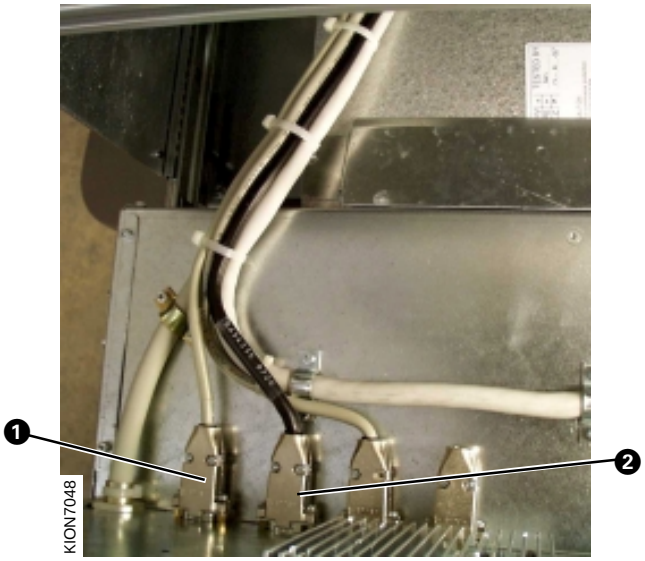


- Disconnect the AC/DC Converter cable (1).
- Disconnect the Isolation transformer cable (2) if fitted (optional).
- Remove the screw (3) and open the Power and communication interface.

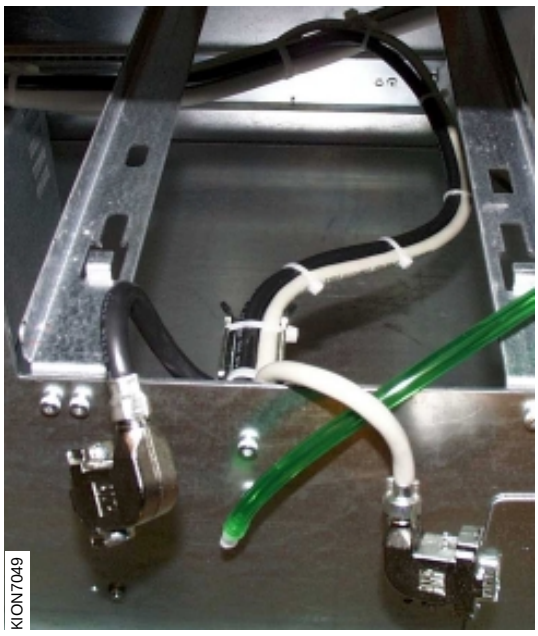


PC 1747 CAN/RS232 INTERFACE (1) is only used by the MGM and may not be installed in KION Systems delivered without MGM. On KION Systems delivered without MGM, the CAN bus-cable (2) is connected to P89 on PC 1753 via a connector adapter.

- When installing an MGM make sure that:
  - PC 1747 CAN/RS232 INTERFACE (1) is installed.
  - The connector adapter is removed and the CAN bus-cable (2) is connected to P92.
  - The short interconnection cable (3) is connected between P93 on PC 1747 and P89 on PC 1753.
- Reassemble the Power and communication interface and connect the AC/DC Converter cable and the Isolation transformer cable (if fitted).

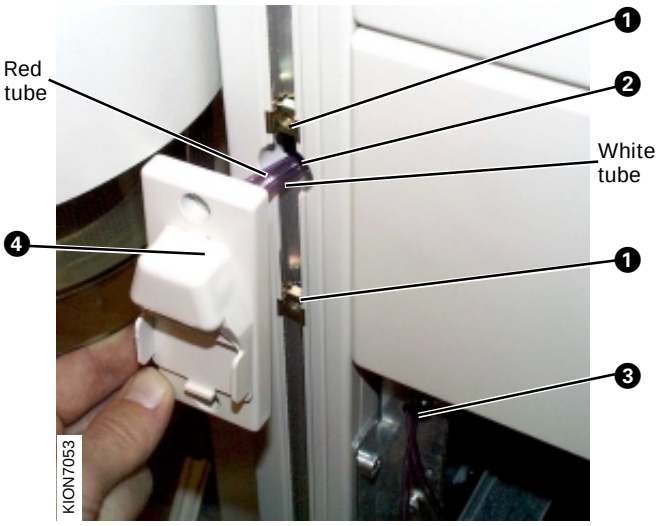


- Connect the MGM communication cable (1).
- Connect the MGM power cable (2).
- Strap the cables as indicated in the illustration.

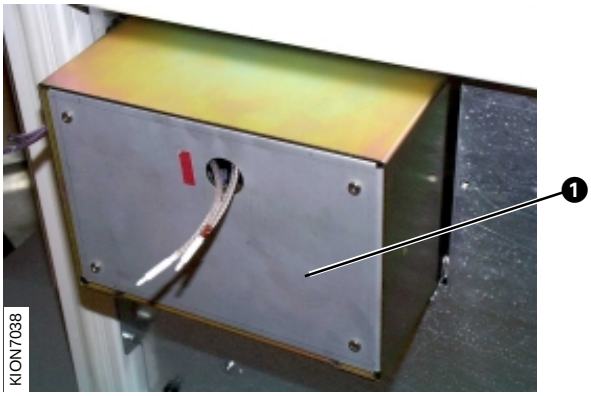


- Remove the two plates covering the MGM compartment, one plate at each side of the trolley.
- Strap the cables as indicated in the illustration.

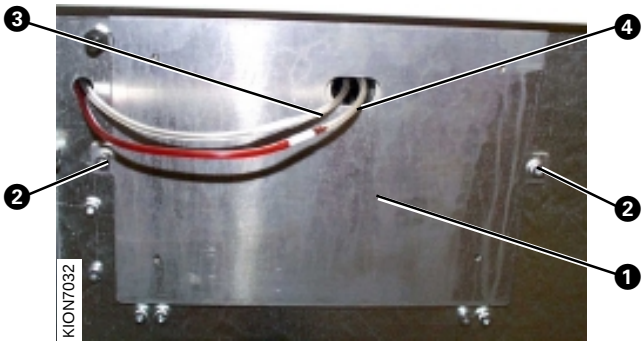
7



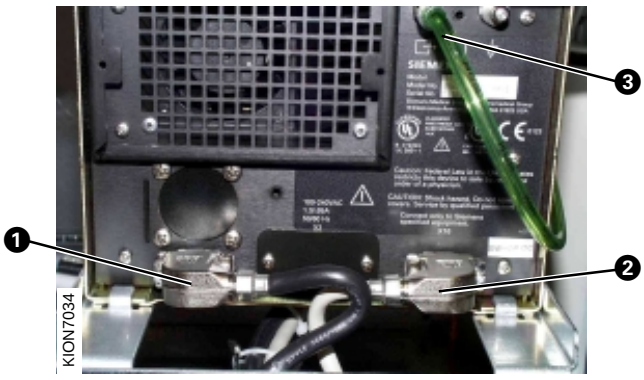
- Remove the plastic strip covering the accessory mounting rail.
- Insert two nuts (1) into the accessory mounting rail.
- Place the sampling tubes in position; in through the hole (2) in the mounting rail and out through the hole (3).
- The sampling tubes are color coded (red and white). It is very important that they are correctly connected. Check that the tubes are connected as indicated in the illustration.
- Mount the water trap manifold (4) onto the accessory rail with the two screws.
- Cut the plastic strip to suitable lengths.
- Re-mount the plastic strips on the accessory mounting rail.



- Slide the MGM (1) in position into the MGM compartment.



- Mount the cover plate (1) using the screws (2).
- Connect the sampling inlet tubes (3 and 4). Make sure that the color codes (red and white) corresponds.



- Connect the:
  - MGM power cable (1).
  - MGM communication cable (2).
- Remove the plug from the MGM sampling outlet tube (3) and connect the tube.

- Mount the new MGM cover (1) using the screws (2). **Note**: The old cover plate (without cut-out for the fan) used on KION System without MGM must not be used. The MGM cover to be used has a cut-out for the MGM ventilation.

- Push in the battery drawer (1), mount the screws (2) and connect the cable (3) .
- Mount the trolley covers.

- Perform a functional verification of the MULTIGAS+ Module. Refer to chapter 6 "Functional Verification", section 1, 2 and 3 in the Service Manual for "MULTIGAS and MULTIGAS+ Modules.
- Perform a "Functional check" of the KION System according to instructions in the "KION - Operating Manual".

7

Extra internal battery

General

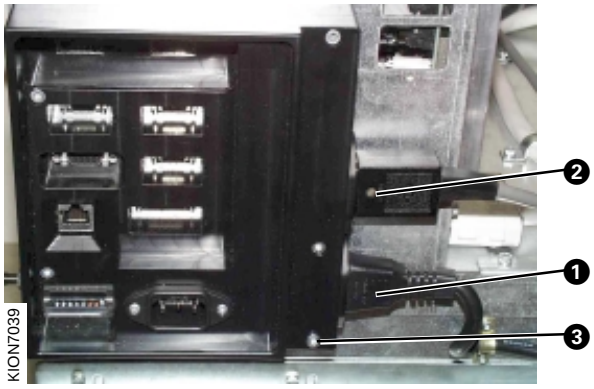
Extra Internal Battery (two serial connected 12 V batteries) can be mounted into the KION System for approx. 90 minutes additional backup time. The extra internal battery gives, together with the internal battery, a total backup time of approx. 120 minutes during normal conditions with fully loaded batteries.

> Only personnel authorized by Siemens shall be permitted to install, service or repair the KION System.
>
> After battery installation or replacement, allow the batteries to recharge before clinical use of the KION System.

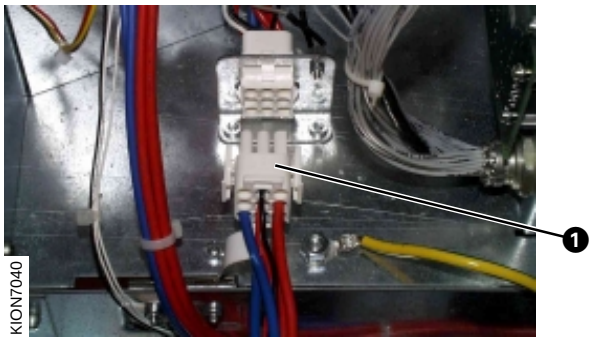
Installation instructions

- Set the power switch on the control panel to **Off**.
- Disconnect the mains power cable.
- Disconnect the gas supplies (wall and tank).

- Remove the trolley cover from the battery drawer.
- Remove the screws (1), disconnect the cable (2) and pull out the battery drawer (3).

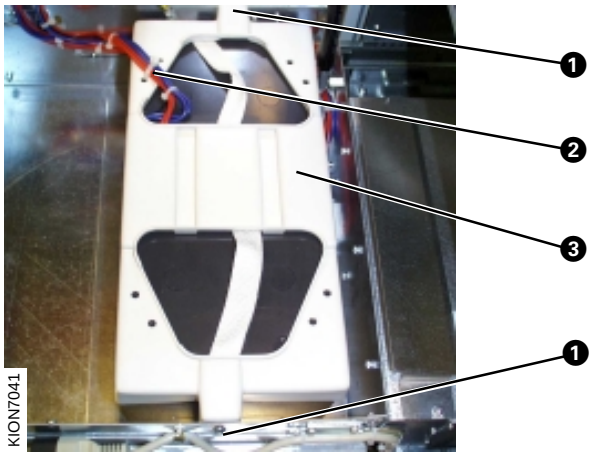


- Disconnect the AC/DC Converter cable (1).
- Disconnect the Isolation transformer cable (2) if fitted (optional).
- Remove the screw (3) and open the Power and communication interface.

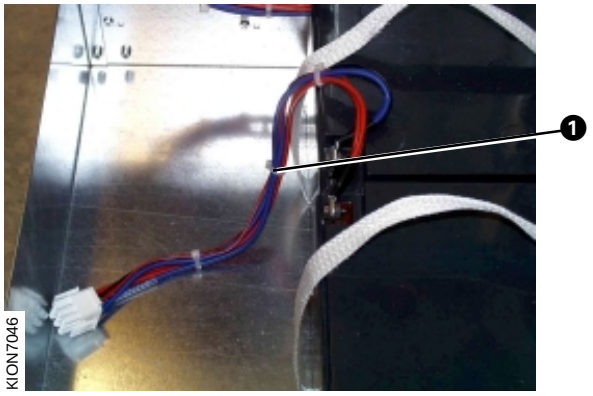


- Disconnect the battery cable (1).

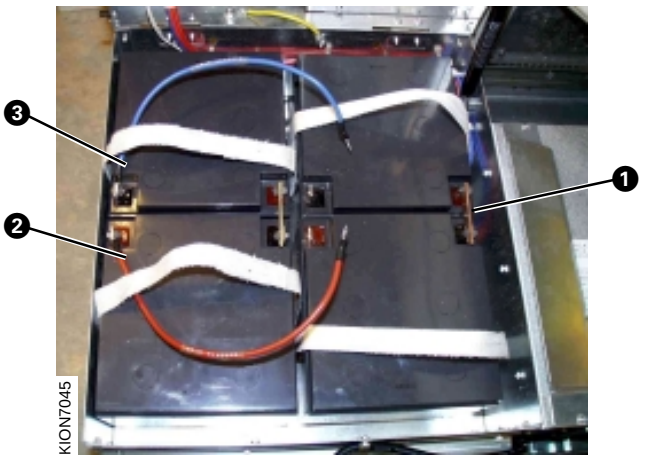
> Always keep the battery cable disconnected when working inside the Power & Communications Interface.
>
> When removing or installing batteries, be very careful with service tools, connection cables, etc, in order not to short-circuit the batteries.



- Remove the two screws (1) securing the battery holder.
- Cut the cable tie (2)
- Lift off the battery holder (3)

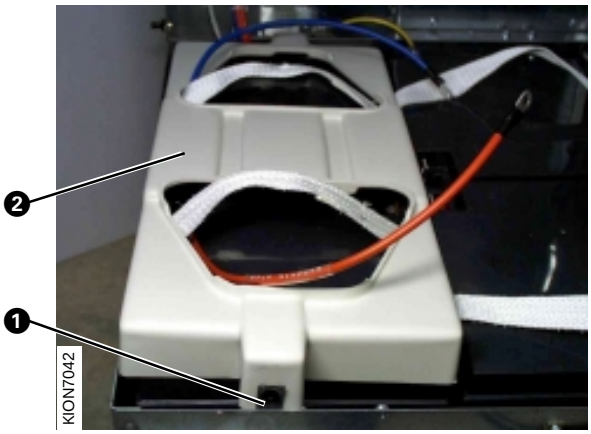


- Disconnect the old battery cable (1) from the internal battery and discard the cable.
  Note: This battery cable (No. 64 34 273) cannot be used when an extra internal battery is connected.

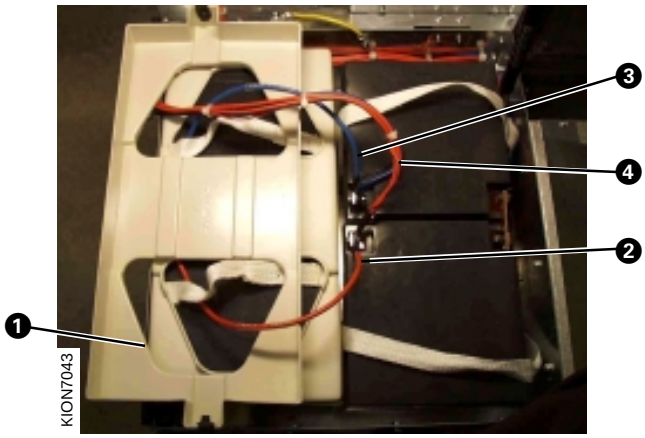


- Prepare the extra internal battery for installation:
  - Mount the pole connection bar (1).
  - Mount the red **+** (2) and blue **–** (3) battery interconnection cables on the battery poles.
  - Place the extra internal battery in position into the battery drawer

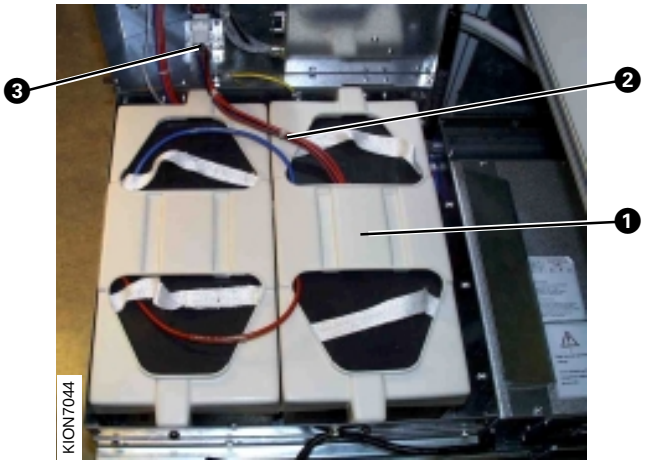
7



- Snap on the nut clips (1) to the battery holder for the extra internal battery.
- Mount the battery holder (2) onto the extra internal battery (two screws).



- Put the internal battery holder (1) upside down on the extra internal battery.
- Place the battery interconnection cables (2 and 3) through the holes in the battery holder (see illustration).
- Connect the battery interconnection cables (2 and 3) and the new battery cable (4) to the internal battery.
  Note: The new battery cable (No. 64 62 407) <u>can only</u> be used when an extra internal battery is connected.



- Mount the battery holder (1) onto the internal battery (two screws).
- Secure the battery cable to the battery holder with a cable tie (2).
- Connect the battery cable (3).

- Re-assemble the battery drawer. The procedure for assembling is the reverse of the disassembly

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procedure previously performed.

- Allow the internal battery to charge until the battery indicator on the KION Display shows "**100%**". This charging time must not be longer than 12 hours.
- Run the KION System on the internal battery (with mains power disconnected) until the alarm "**No Battery Capacity Left**" is activated. This event is logged in the Diagnostic Log. There is no need to supervise the KION System during the test.
- Verify the condition of the battery by checking the Diagnostic Log. The time between the alarm **"Disconnect"** and the alarm "**Limited Battery Capacity Left**" must be at least 40 min or 130 min if the KION System is equipped with Extra internal battery (optional). Also check that the time between the alarm "**Limited Battery Capacity Left**" and the alarm "**No Battery Capacity Left**" is approx. 10 min.
- Allow the internal battery to charge until the battery indicator on the KION Display shows "**100%**". This charging time must not be longer than 12 hours. If "**100%**" is not reached within 12 hours, the battery does not work properly and must be replaced.

- Perform a "Functional check" of the KION System according to instructions in the "KION - Operating Manual".

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Isolation transformer

General

KION7029

An optional Isolation Transformer can be mounted into the KION System. The isolation transformer contains four mains power outlets (115 or 230 V). Max. outlet is 500 VA. The isolation transformer is equipped with two resetable fuses on the primary side and two fuses on the secondary side.

For further information regarding function, operation and technical specifications, see the "KION Isolation Transformer – Operating Manual".

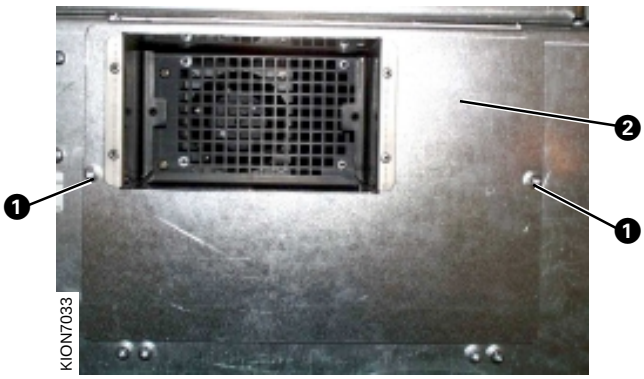
Only personnel authorized by Siemens shall be permitted to install, service or repair the KION System.

Installation instructions

- Set the power switch on the control panel to **Off**.
- Disconnect the mains power cable.
- Disconnect the gas supplies (wall and tank).

KION7037

- Remove the lower trolley covers from all four sides of the trolley.
- Remove the screws (1), disconnect the cable (2) and pull out the battery drawer (3).



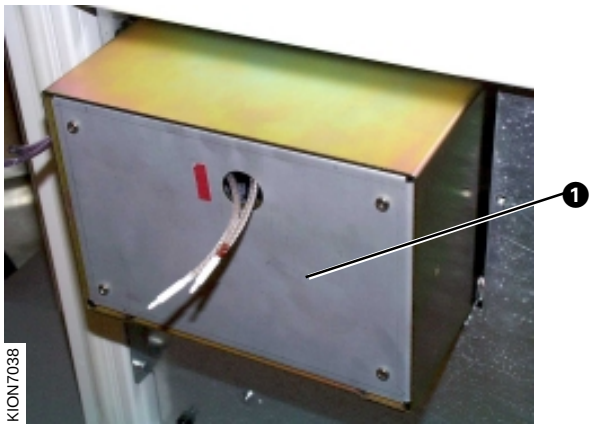
KION7033

To make space for the isolation transformer during the installation procedure, the Multi-gas module including its mounting brackets must be removed. (The Multi-gas module will be re-mounted when the isolation transformer is installed.)

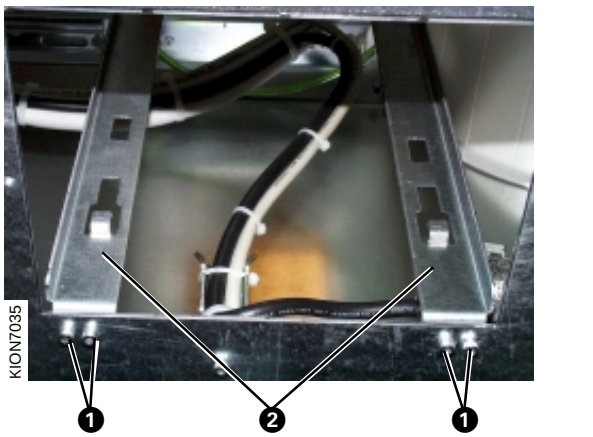
- Remove the screws (1) and lift off the MGM cover (2).

- Disconnect the:
  - MGM power cable (1).
  - MGM communication cable (2).
  - MGM sampling outlet tube (3).

- Disconnect the sampling inlet tubes (1 and 2).
- Remove the screws (3).



- Pull out and lift off the Multi-gas module (1).



- Remove the eight screws (1) holding the mounting brackets (there are four screws at each end of the mounting brackets).
- Lift off the mounting brackets (2).

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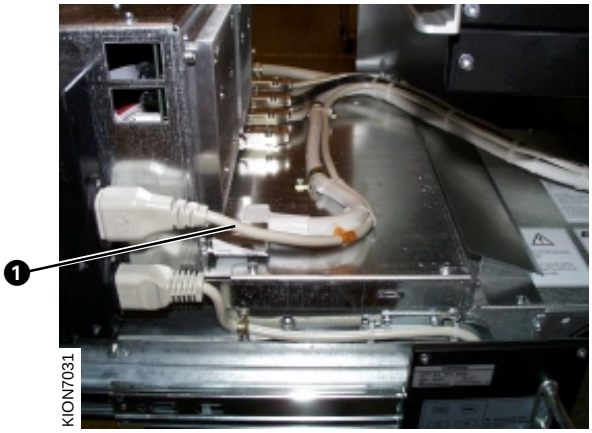
The isolation transformer can now be installed.

- Place the isolation transformer (1) in position inside the trolley and mount it with the four nuts (2) delivered with the transformer kit.
  Note 1: The nuts and washers that are already mounted on the four studs are used as spacers and must not be removed.
  Note 2: The nuts (2) must secured with Loctite 242 (or similar threadlocking compound).



- Secure the isolation transformer cable (1) with cable straps as indicated in the illustration.
- Connect the isolation transformer cable to the upper mains power outlet.

- Re-mount the Multi-gas module including its mounting brackets. The procedure for assembling is the reverse of the disassembly procedure previously performed.

- Mount all trolley covers. Use the cover (1) delivered with the isolation transformer to make the transformer outlets accessible.
- Attach the label (2) on the trolley cover as indicated in the illustration.

- Perform a "Functional check" of the KION System according to instructions in the "KION - Operating Manual".
- Hand over the "KION Isolation Transformer – Operating Manual" to the customer.

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KION9010

Backup gas supply manifold

General

The KION System can be equipped with a Backup Gas Supply Manifold with connections for 4 gas cylinders. The connections are intended for:

- N_2O (one gas cylinder)
- AIR (one gas cylinder)
- O_2 (two gas cylinders)

The cylinder gas pressure is reduced to a suitable pressure by the preset pressure regulators. The gas is then connected to the gas distribution block inside the pneumatic section via internal tubing.

The integrated pressure transducers are connected to PC 1733 INTERCONNECTION . The gas pressure in the cylinders can be displayed on the KION Display, and alarm is activated if the pressure is outside the preset alarm limits.

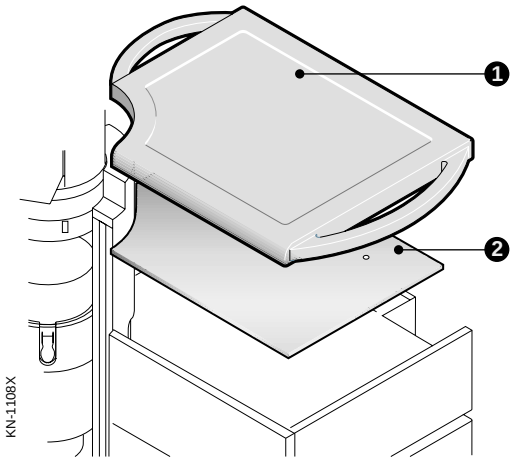
For further information regarding function, operation and technical specifications, see the "KION Backup Gas Supply Manifold – Operating Manual".

Only personnel authorized by Siemens shall be permitted to install, service or repair the KION System.

Field upgrade with a Backup Gas Supply Manifold is possible only on KION Systems with Serial No. 00412 or higher.

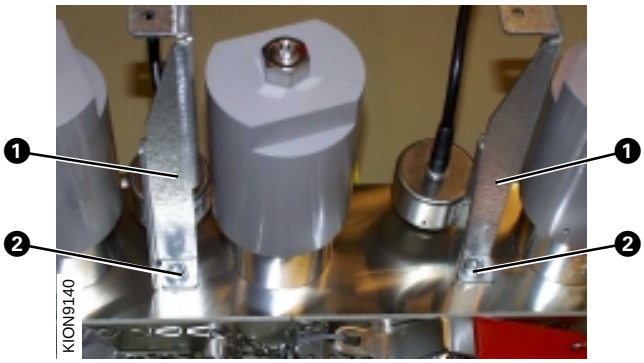
Installation instructions

- Set the power switch on the control panel to **Off**.
- Disconnect the mains power cable.
- Disconnect the gas supplies.

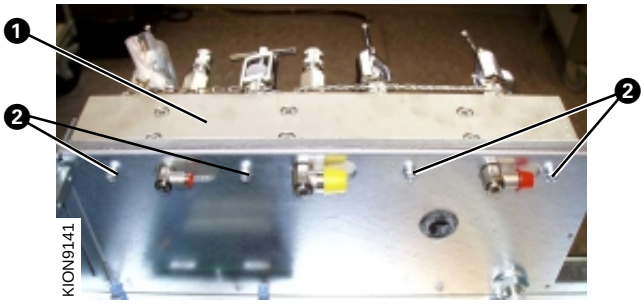


KN-1108X

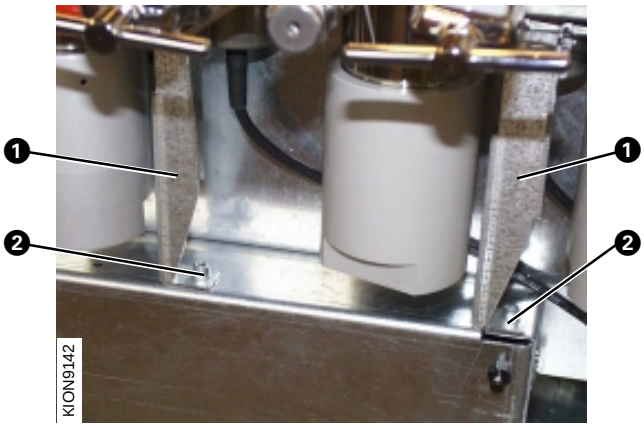
- Lift off the top cover (1) and the shield cover (2).
  Note 1: If the KION System is equipped with a monitor shelf; lift off the monitor and remove the monitor shelf support leg before removing the top cover (1).
  Note 2: The shelf in the cover can slide out if the cover is tilted.
- Remove the big trolley cover on the rear side of the KION System.



- Mount the two support legs (1) on the manifold. Use M6x14 mm screws (2).



- Disconnect and remove the fresh gas pressure container from the pneumatic section. It is not possible to connect the manifold tubings unless the fresh gas pressure container is removed.
- Mount the manifold (1) onto the KION System. Use M6x14 mm screws (2) and washers.



- Secure the support legs (1). Use M5x10 mm screws (2).

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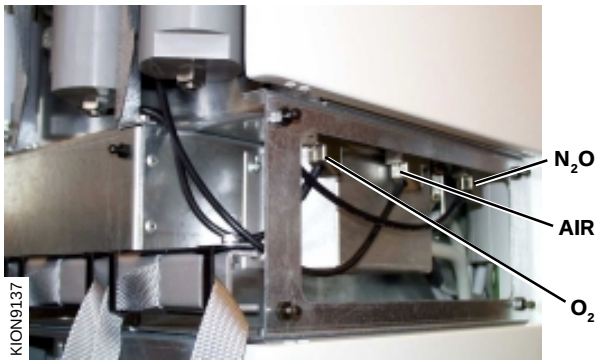
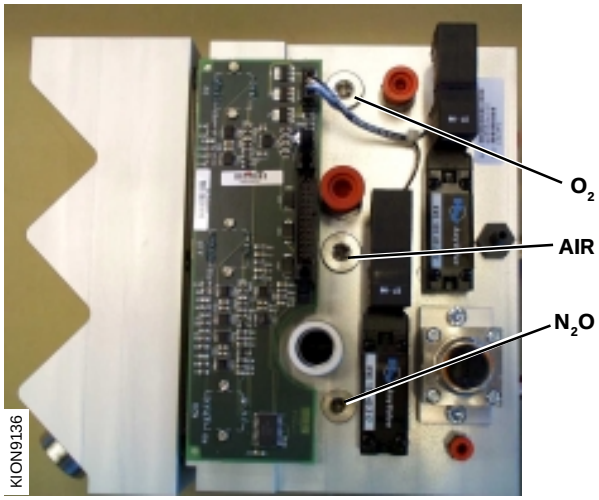
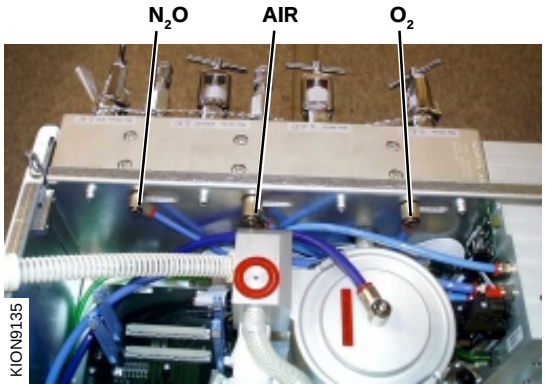


- Remove the trolley cover to make the connectors on the underside of PC 1733 INTERCONNECTION accessible.
- Connect the pressure transducer cables.
- Remount the trolley cover.



- Remove the plugs from the three backup gas inlets on the gas distribution block.
- Mount the tube connectors in these gas inlets. The tube connectors have different sizes and different threads to avoid mixing.



- Connect the gas tubes between the manifold and the gas distribution block.
- Mount the fresh gas pressure container into the pneumatic section. Connect all tubes to the fresh gas pressure container.

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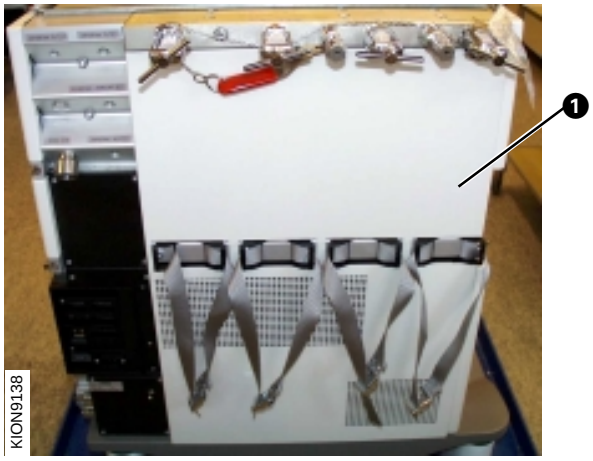
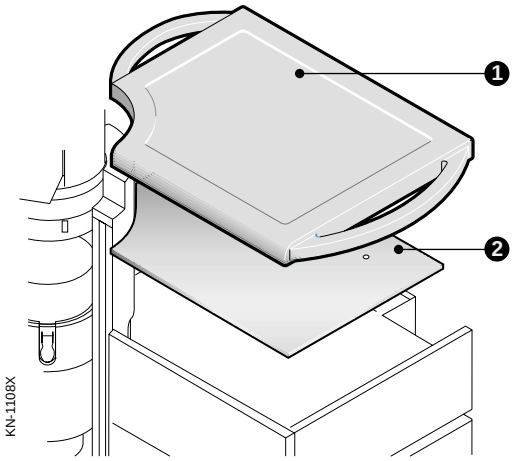
- Mount the four straps (1) onto the strap holder bar (2). **Note**: The strap buckle on the right side as showed in the illustration.
- Mount the strap holder bar (2) onto the KION System. Use M6x35 mm screws (3) and washers.
- Mount the cylinder support (4) onto the strap holder bar. Use M6x35 mm screws (5) and washers.
  Note: The cylinder support (4) must be adjusted in order to support the gas cylinders in a vertical angle.



- Mount the new trolley cover (1).



- Re-mount the shield cover (2) and the top cover (1).
  Note 1: The shelf in the cover can slide out if the cover is tilted.
  Note 2: If the KION System is equipped with a monitor shelf; re-mount the monitor shelf support leg and put the monitor in place on the shelf.

- Connect gas cylinders to the gas supply manifold.
- Perform a "Functional check" of the KION System according to instructions in the "KION - Operating Manual".
- Perform a "Function check" of the gas supply manifold according to instructions in the "KION Backup Gas Supply Manifold – Operating Manual".

- Select the suitable language version of the "KION Backup Gas Supply Manifold – Operating Manual" and hand it over to the customer.

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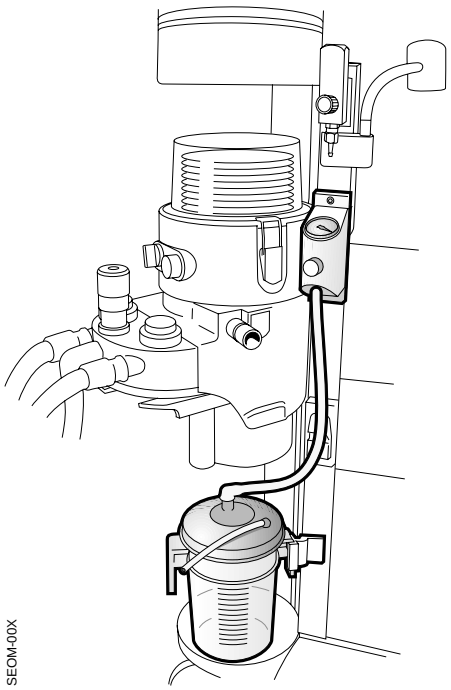


Suction equipment

General

The optional KION Suction equipment can be mounted on the KION System. The main parts of the KION Suction equipment are:

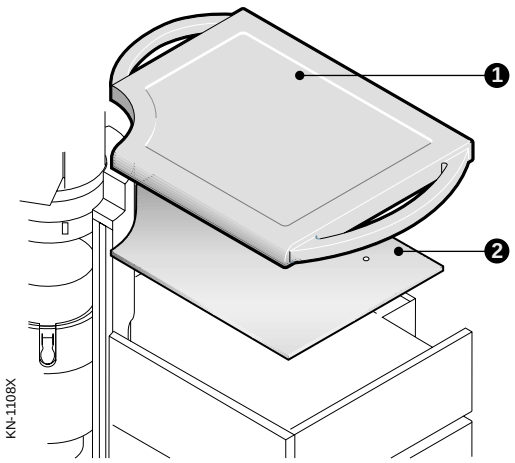
- Suction ejector that creates the vacuum. The suction ejector is powered with drive gas from the gas distribution block.
- Suction bottle. The Siemens 1.8 liter bottle is recommended.

For further information regarding function, operation and technical specifications, see the "KION Suction Ejector – Operating Manual".

> Only personnel authorized by Siemens shall be permitted to install, service or repair the KION System.

Installation instructions

- Set the power switch on the control panel to **Off**.
- Disconnect the mains power cable.
- Disconnect the gas supplies (wall and tank).



- Lift off the top cover (1) and the shield cover (2).
  Note 1: If the KION system is equipped with a monitor shelf; lift off the monitor and remove the monitor shelf support leg before removing the top cover (1).
  Note 2: The shelf in the cover can slide out if the cover is tilted.

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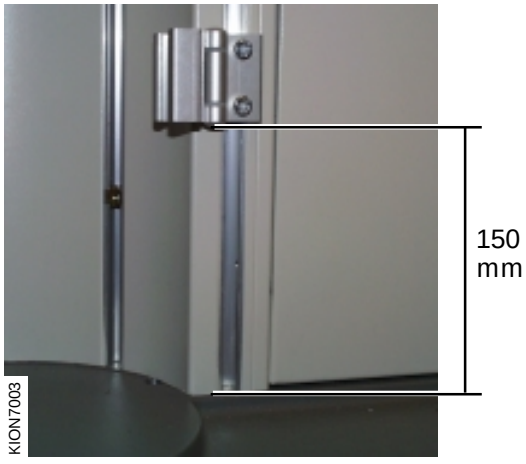
- Remove the plastic strips (1 and 2) covering the accessory mounting rail above and below the water trap manifold.

- If necessary, insert nuts (1) into the accessory mounting rail:
  - Two nuts are required for the suction ejector (above the water trap manifold).
  - Two nuts are required for the suction bottle holder (below the water trap manifold).



- Mount the suction bottle bracket as indicated in the illustration.

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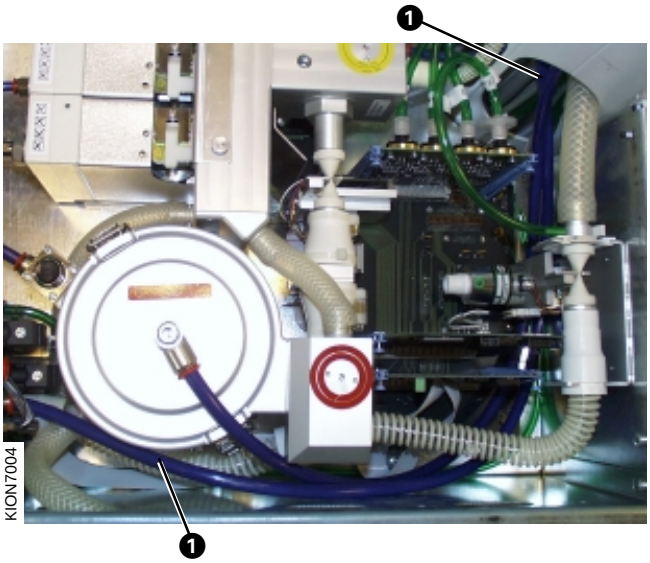
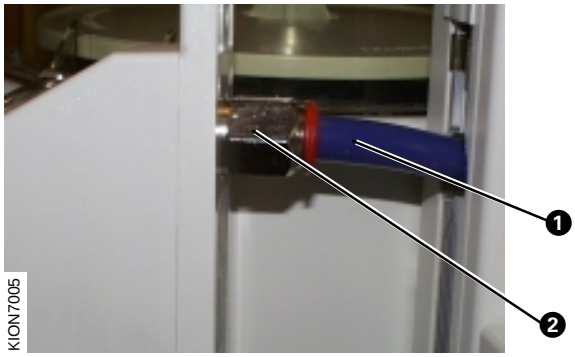
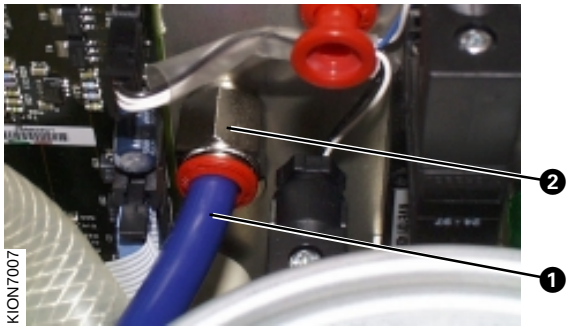


- Place the drive gas tube (1) in position into the pneumatic section as illustrated.

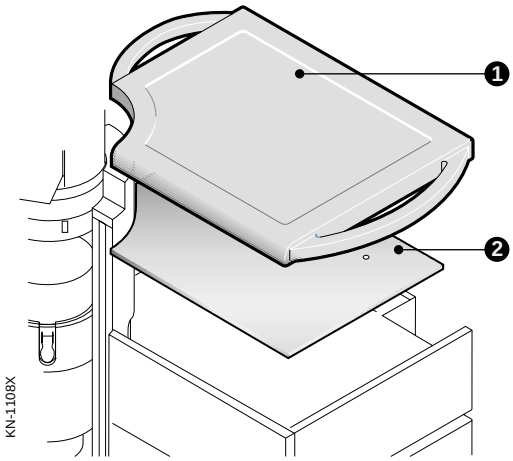


- Connect the drive gas tube (1) to the suction ejector drive gas inlet (2).

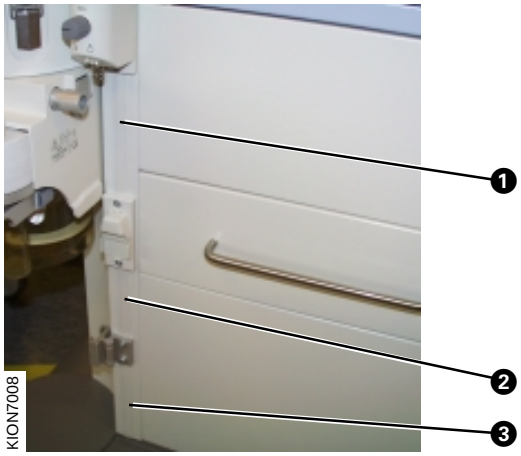
- Mount the suction ejector on the accessory mounting rail using the two screws delivered with the suction ejector.



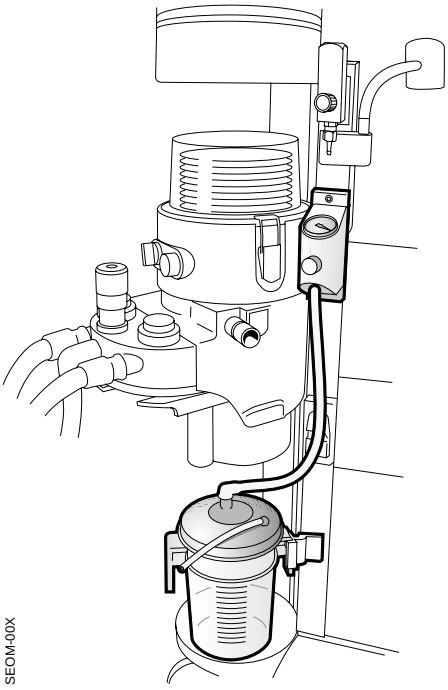
- Remove the plug from the AIR supply outlet in the gas distribution block.
- Connect the drive gas tube (1) to the AIR supply outlet (2).



- Re-mount the shield cover (2) and the top cover (1).
  Note 1: The shelf in the cover can slide out if the cover is tilted.
  Note 2: If the KION System is equipped with a monitor shelf; re-mount the monitor shelf support leg and put the monitor in place on the shelf.



- Cut the plastic strips (2 and 3) to suitable lengths.
- Re-mount the plastic strips (1, 2 and 3) on the accessory mounting rail.



- Remove the two straight connection nipples from the suction bottle and connect the two angled nipples.
- Mount the suction bottle on the mounting bracket.
- Connect the suction tube between the suction bottle and the suction ejector.

- Perform a "Functional check" of the KION System according to instructions in the "KION - Operating Manual".
- Perform a "Function check" of the suction equipment according to instructions in the "KION Suction Ejector – Operating Manual".

- Hand over the Operating Manuals for the KION Suction Ejector and for the Suction Bottle to the customer.

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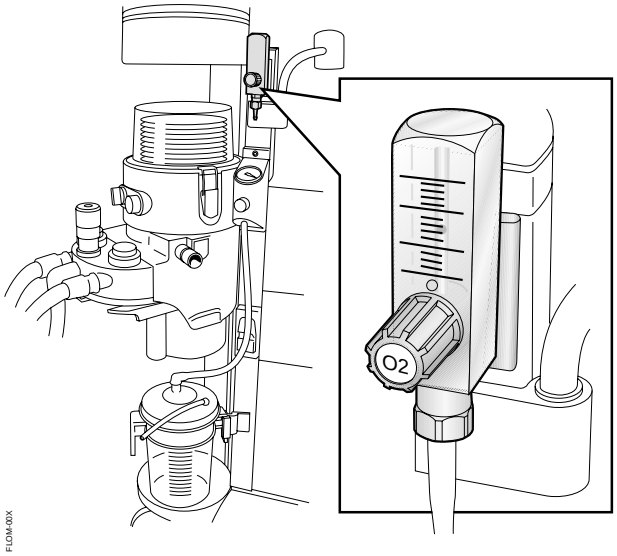


Auxiliary O_2 Supply

General

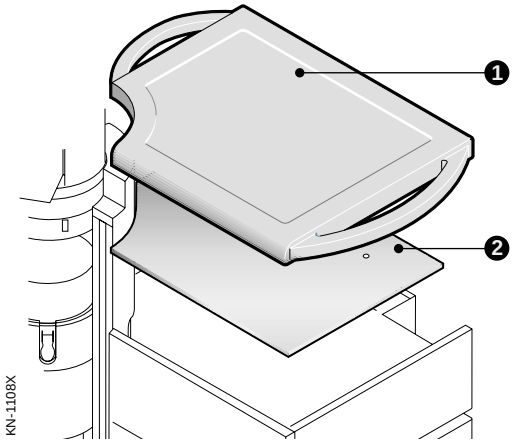
The optional KION Auxiliary O_2 Supply (Auxiliary O_2 Flowmeter) can be mounted on the KION System. The flowmeter is supplied with O_2 from the gas distribution block.

For further information regarding function, operation and technical specifications, see the "KION Auxiliary Oxygen Flowmeter – Operating Manual".

Only personnel authorized by Siemens shall be permitted to install, service or repair the KION System.

Installation instructions

- Set the power switch on the control panel to **Off**.
- Disconnect the mains power cable.
- Disconnect the gas supplies (wall and tank).



- Lift off the top cover (1) and the shield cover (2).
  Note 1: If the KION System is equipped with a monitor shelf; lift off the monitor and remove the monitor shelf support leg before removing the top cover (1).
  Note 2: The shelf in the cover can slide out if the cover is tilted.

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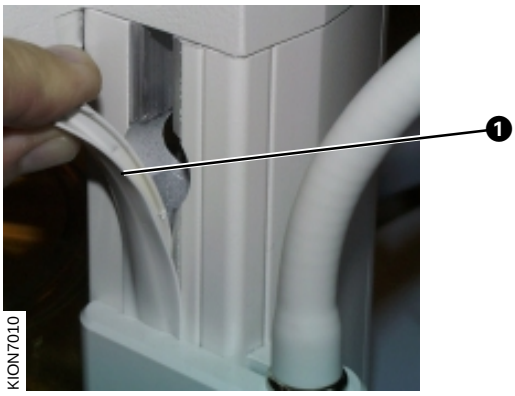
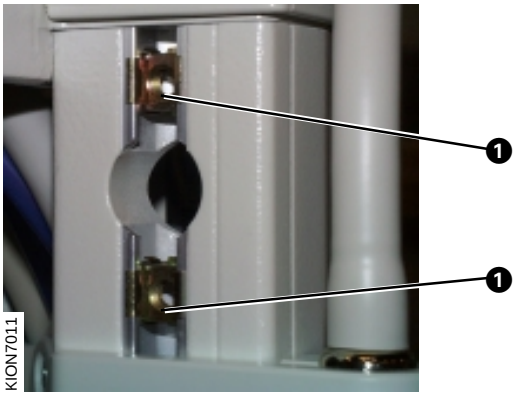
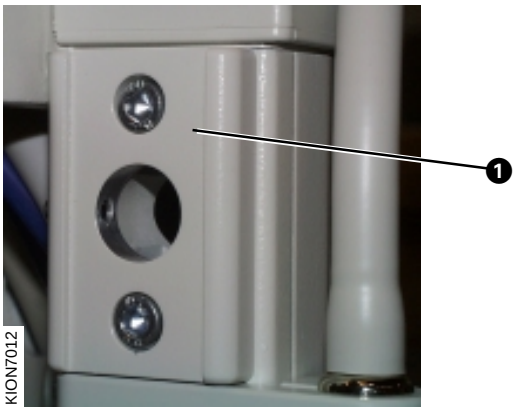


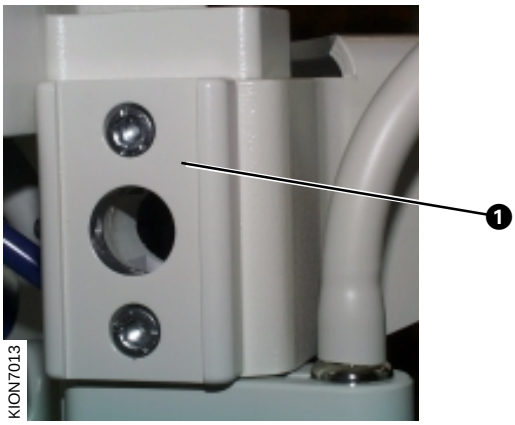
- If the KION System is not equipped with an accessory/monitor shelf:
  - Remove the plastic strip (1) covering the accessory mounting rail.



- If necessary, insert nuts (1) into the accessory mounting rail. Two nuts are required for the flowmeter.



- Mount the flowmeter holder (1) on the accessory mounting rail using the two screws delivered with the flowmeter. Make sure that the hole in the flowmeter holder is centered to the corresponding hole in the accessory mounting rail.



- If the KION System is equipped with an accessory/monitor shelf:
  - Remove the shelf bracket mounting plate and replace it with the flowmeter holder (1). Use the longer screws from the removed mounting plate, not the short screws delivered with the flowmeter. Make sure that the hole in the flowmeter holder is centered to the corresponding hole in the mounting rail.

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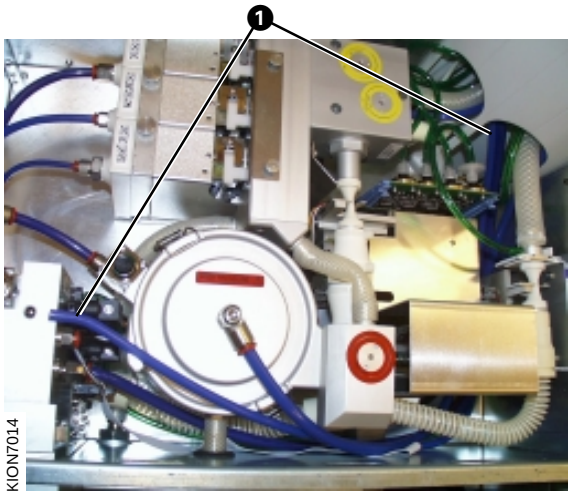
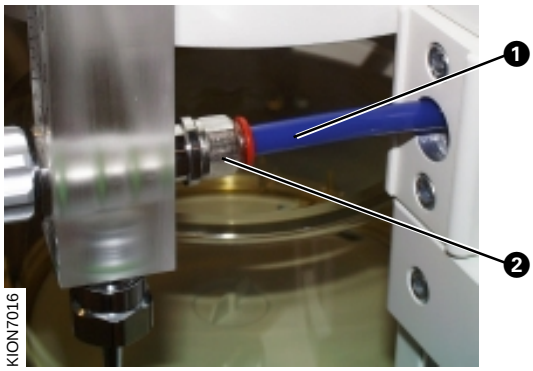
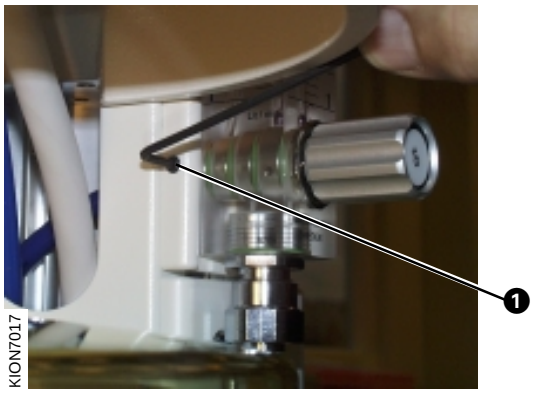


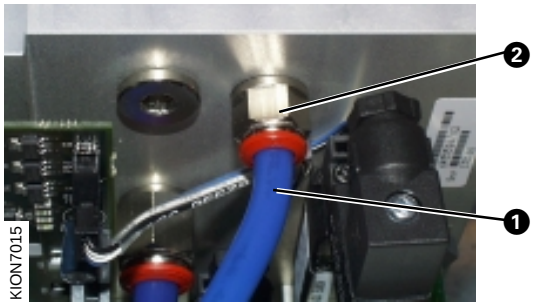
- Place the O_2 tube (1) in position into the pneumatic section as illustrated.



- Connect the O_2 tube (1) to the O_2 inlet (2) on the flowmeter.



- Mount the flowmeter onto the flowmeter holder. Secure the flowmeter with the screw (1).



- Remove the plug from the O_2 supply outlet in the gas distribution block.
- Connect the O_2 tube (1) to the O_2 supply outlet (2).

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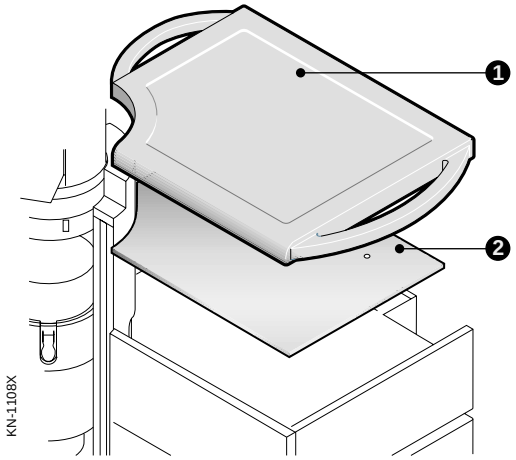


- Re-mount the shield cover (2) and the top cover (1).
  Note 1: The shelf in the cover can slide out if the cover is tilted.
  Note 2: If the KION System is equipped with a monitor shelf; re-mount the monitor shelf support leg and put the monitor in place on the shelf.

- Perform a "Functional check" of the KION System according to instructions in the "KION - Operating Manual".
- Perform a "Function check" of the flowmeter according to instructions in the "KION Auxiliary Oxygen Flowmeter – Operating Manual".

- Hand over the "KION Auxiliary Oxygen Flowmeter – Operating Manual" to the customer.

7

Gas evacuation

General

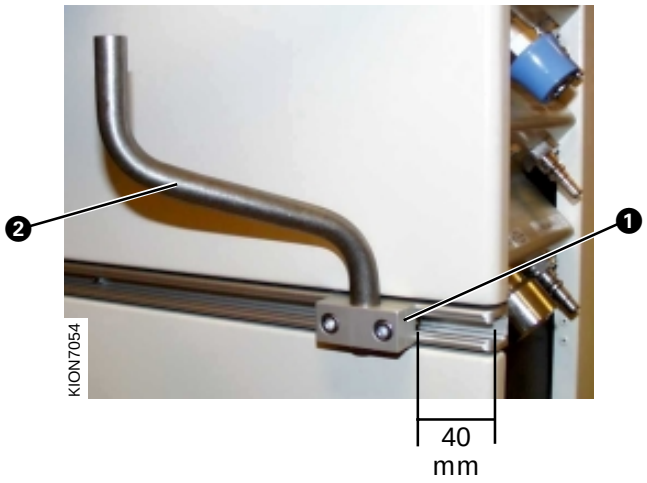
The optional KION Evac System to be used is the Servo Evac 180. To be mounted onto the KION System, the Servo Evac 180 must be equipped with a bracket and a holder arm.

For further information regarding function, operation and technical specifications, see the "Servo Evac 180 – Operating Manual".

Only personnel authorized by Siemens shall be permitted to install, service or repair the KION System.

Installation instructions

- Set the power switch on the control panel to **Off**.
- Disconnect the mains power cable.
- Disconnect the gas supplies (wall and tank).



- Mount the rail clamp (1) and the arm (2) on the trolley as indicated in the illustration. Do not tighten the screws yet.

7

KION7055

- Mount the Servo Evac 180 onto the arm.
- Adjust the arm and the Servo Evac 180 to a suitable position and tighten the screws.

KION7056

- Connect tubings to the Servo Evac 180.

- Perform a ”Functional check” of the KION Evac System according to instructions in the ”Servo Evac 180 – Operating Manual”.

- Select the suitable language version of the ”Servo Evac 180 – Operating Manual” and hand it over to the customer.

7

8. Diagrams

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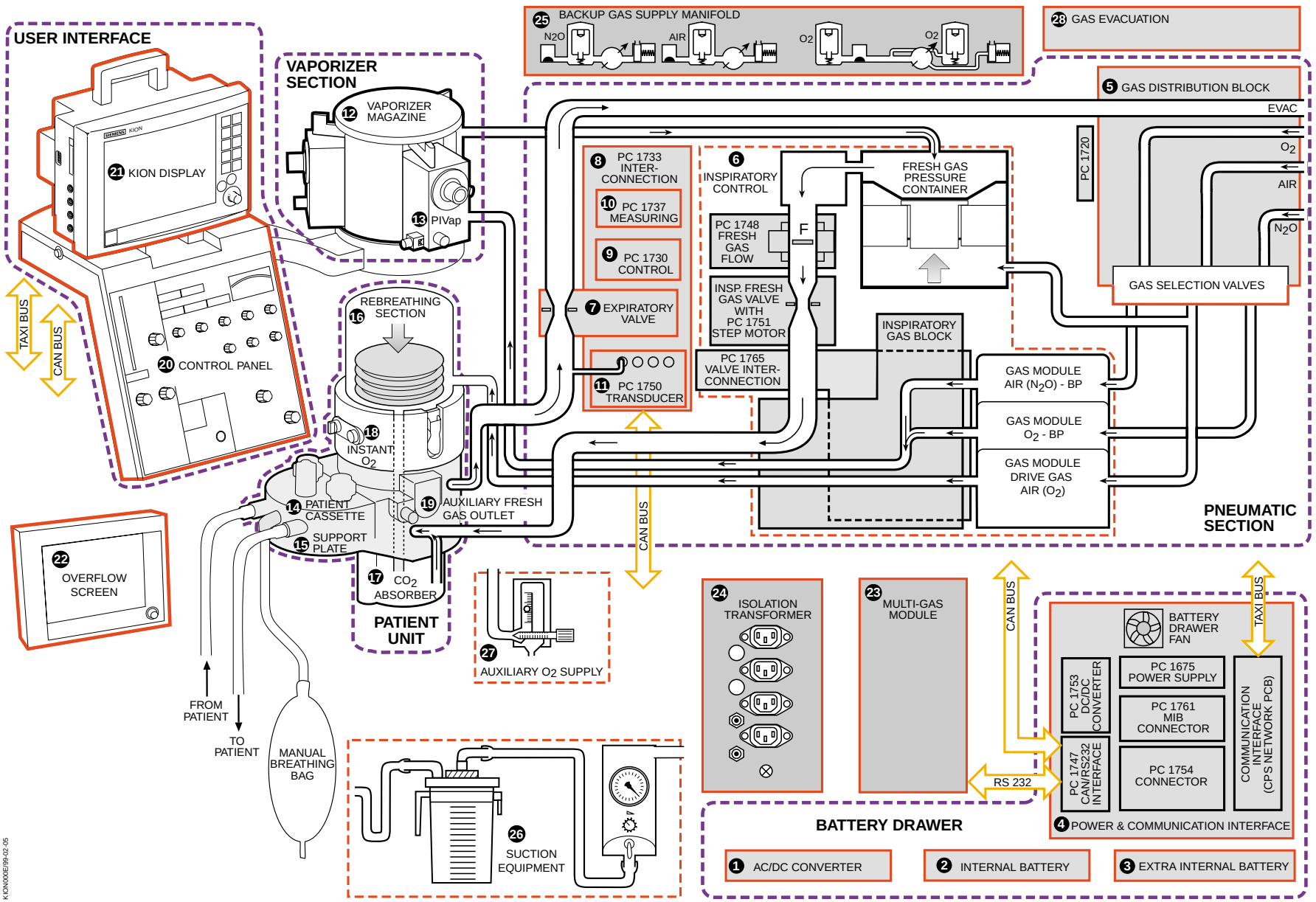
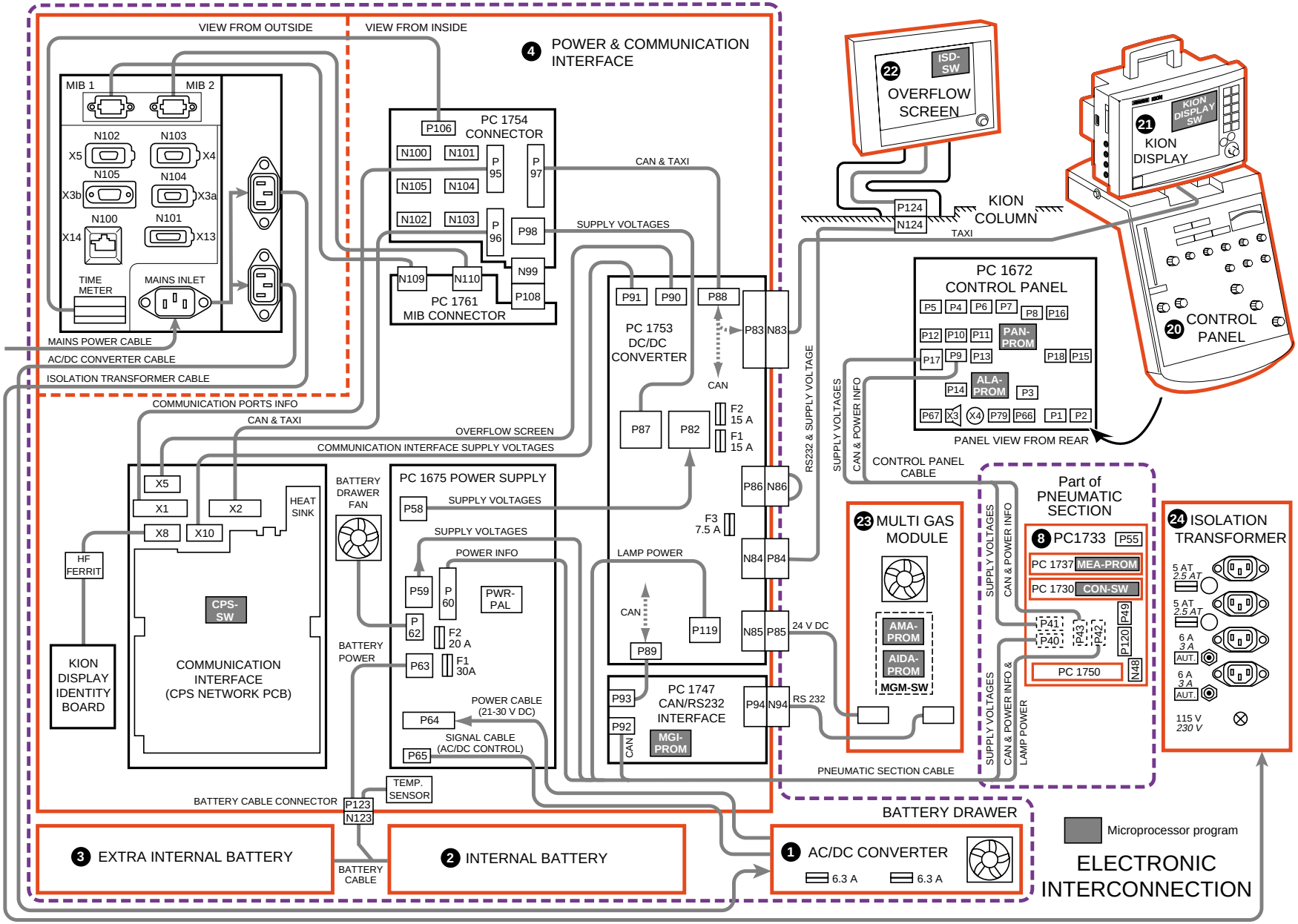
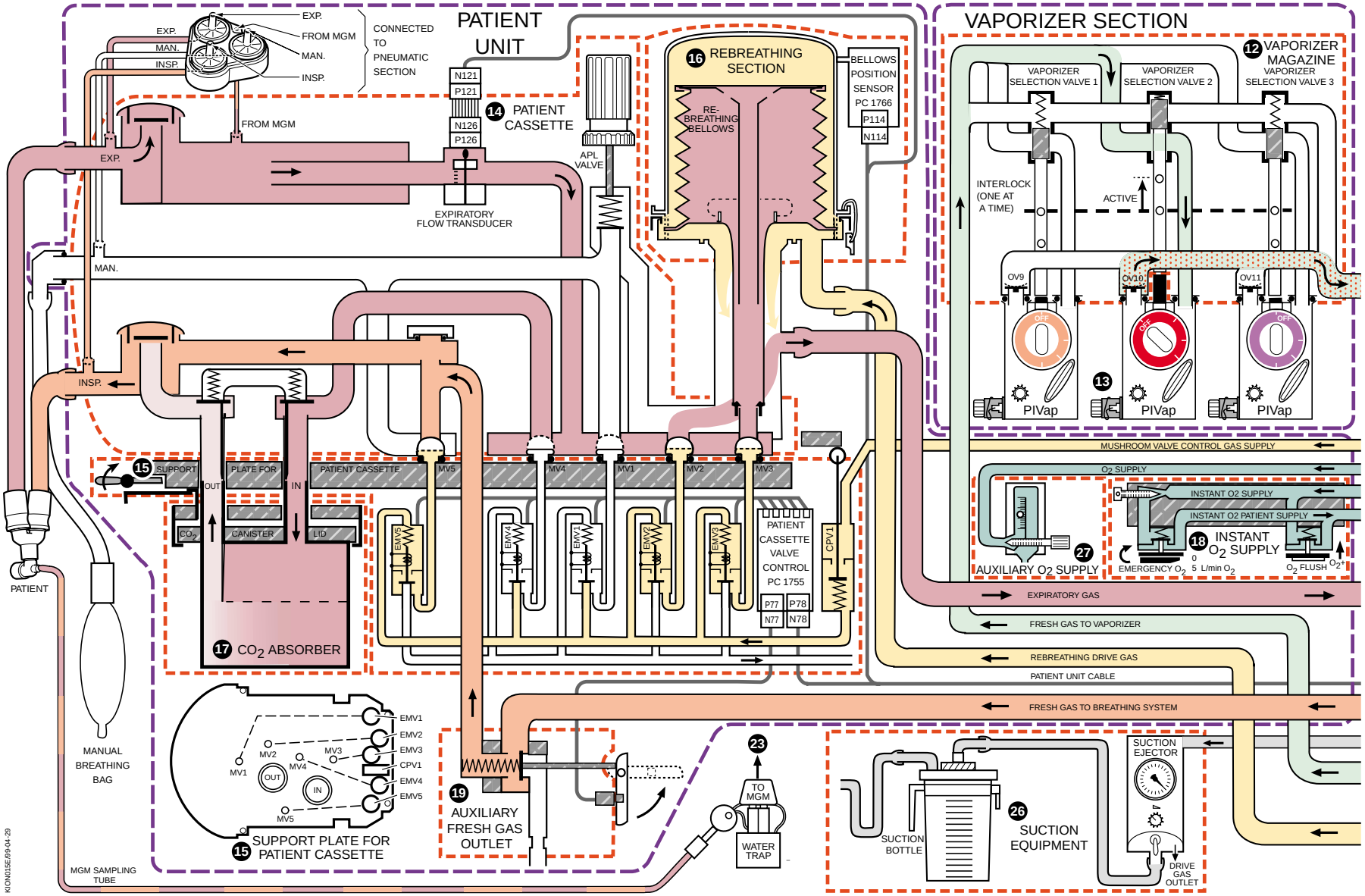


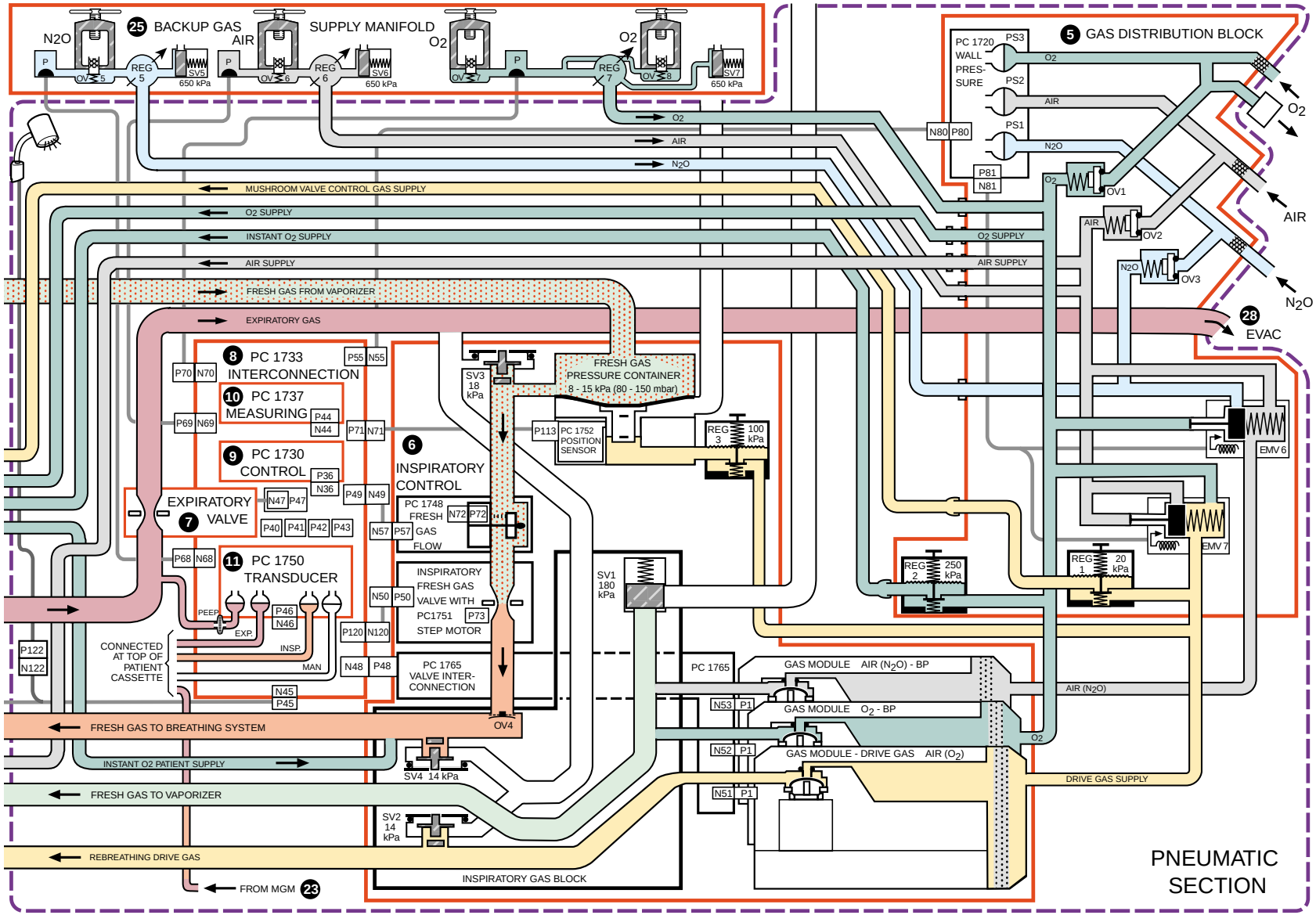
Basic principles



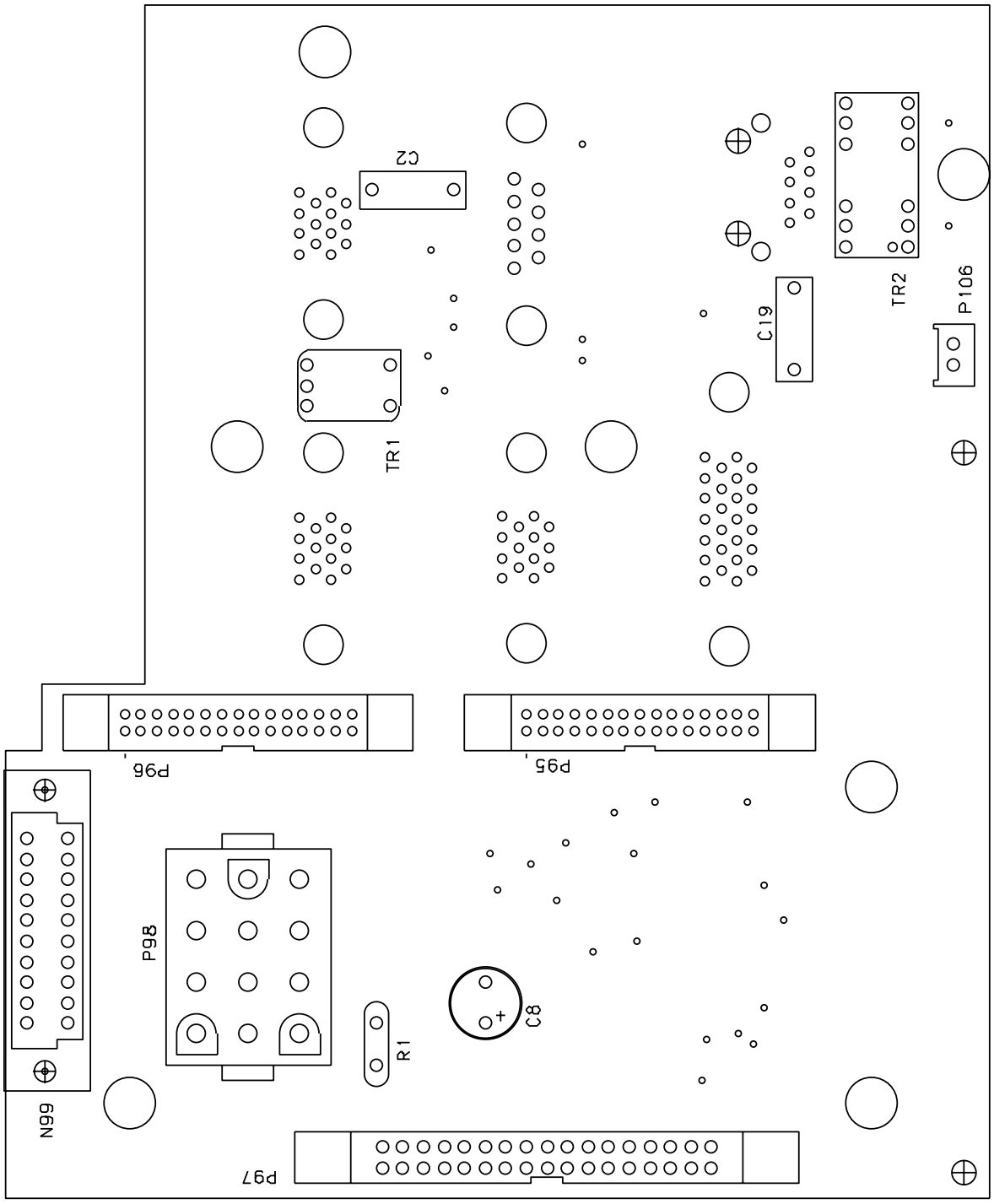
Electronic interconnection



Patient unit and vaporizer section

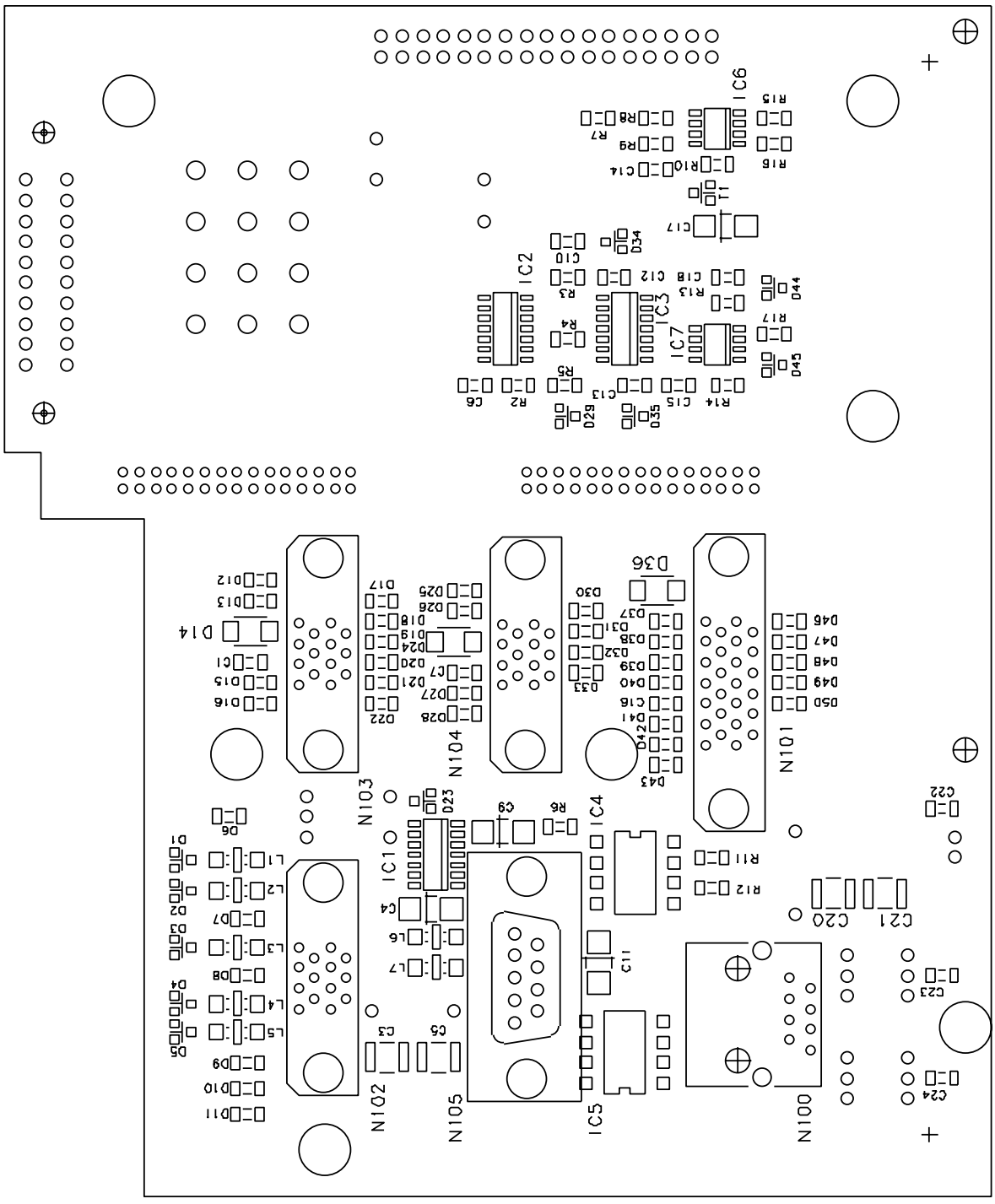


Pneumatic section



PC 1754 Connector – Layout, page 1 (2)

8



PC 1754 Connector – Layout, page 2 (2)

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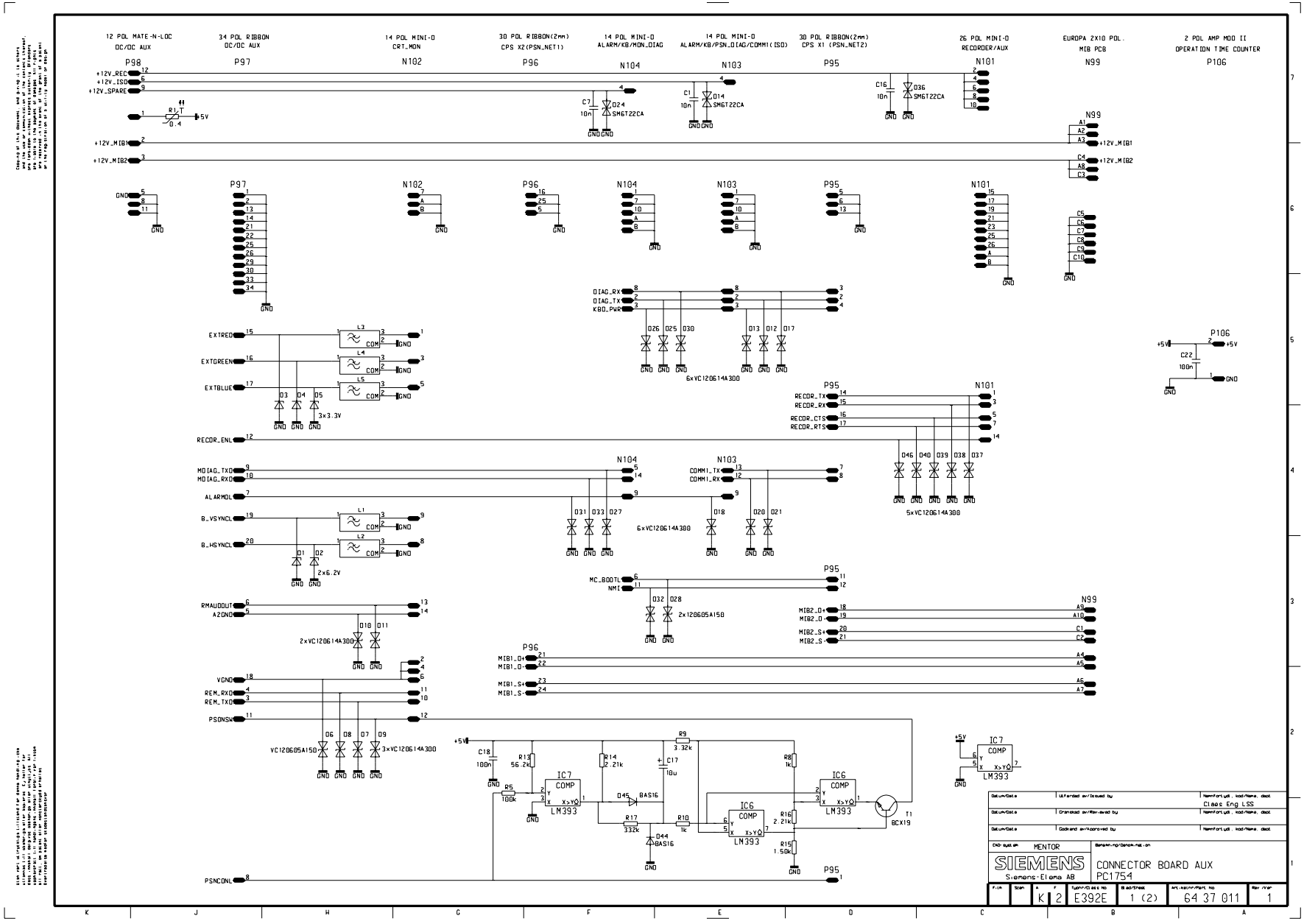
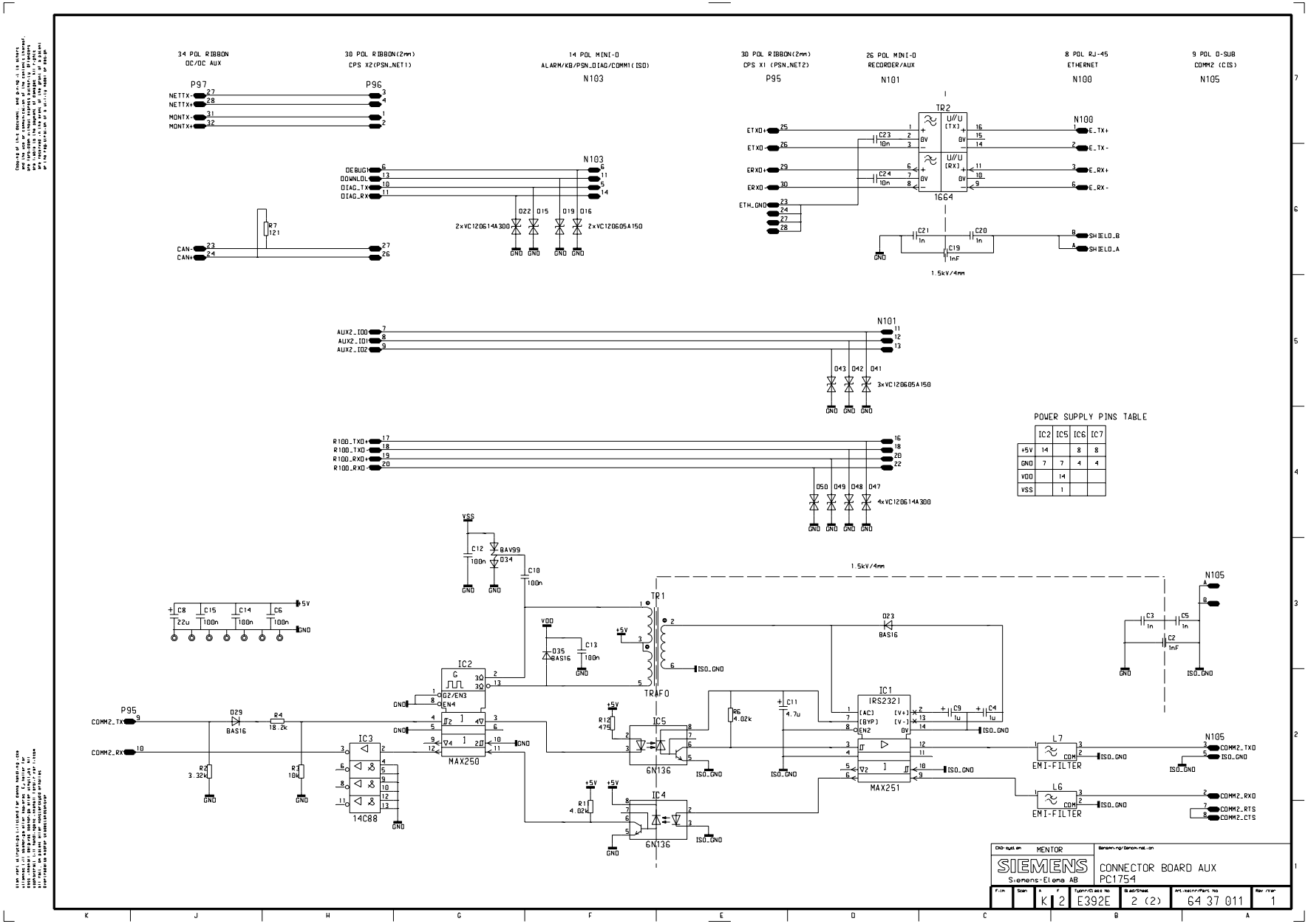


PC 1754 Connector – Circuit diagram, page 1 (2)



PC 1754 Connector – Circuit diagram, page 2 (2)

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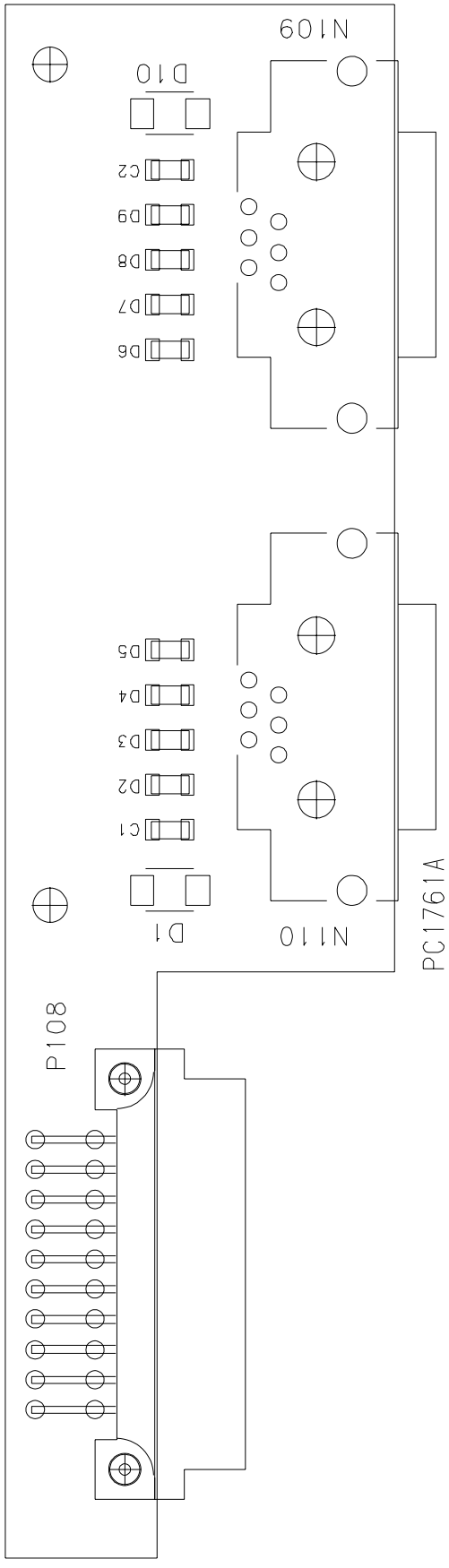
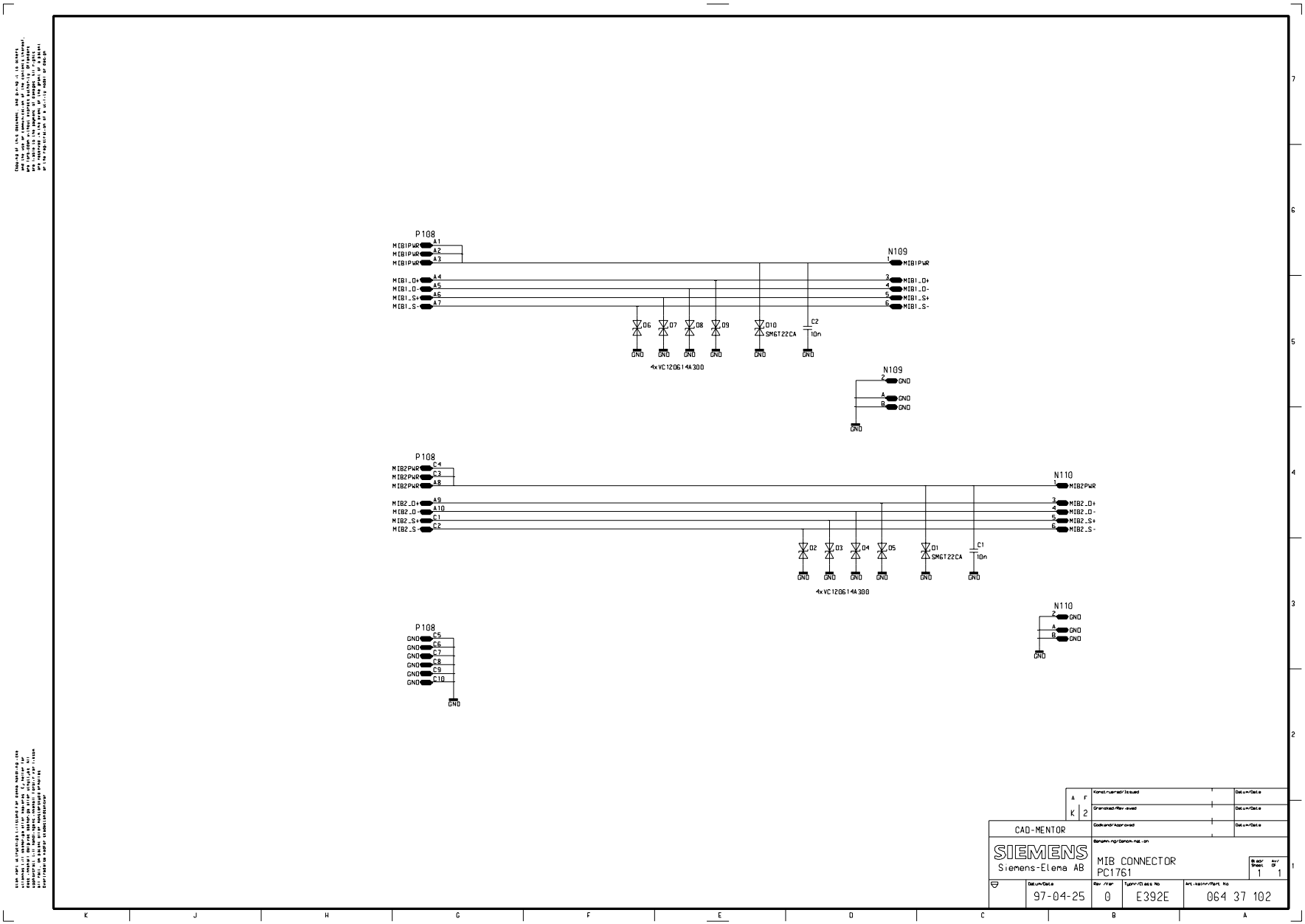
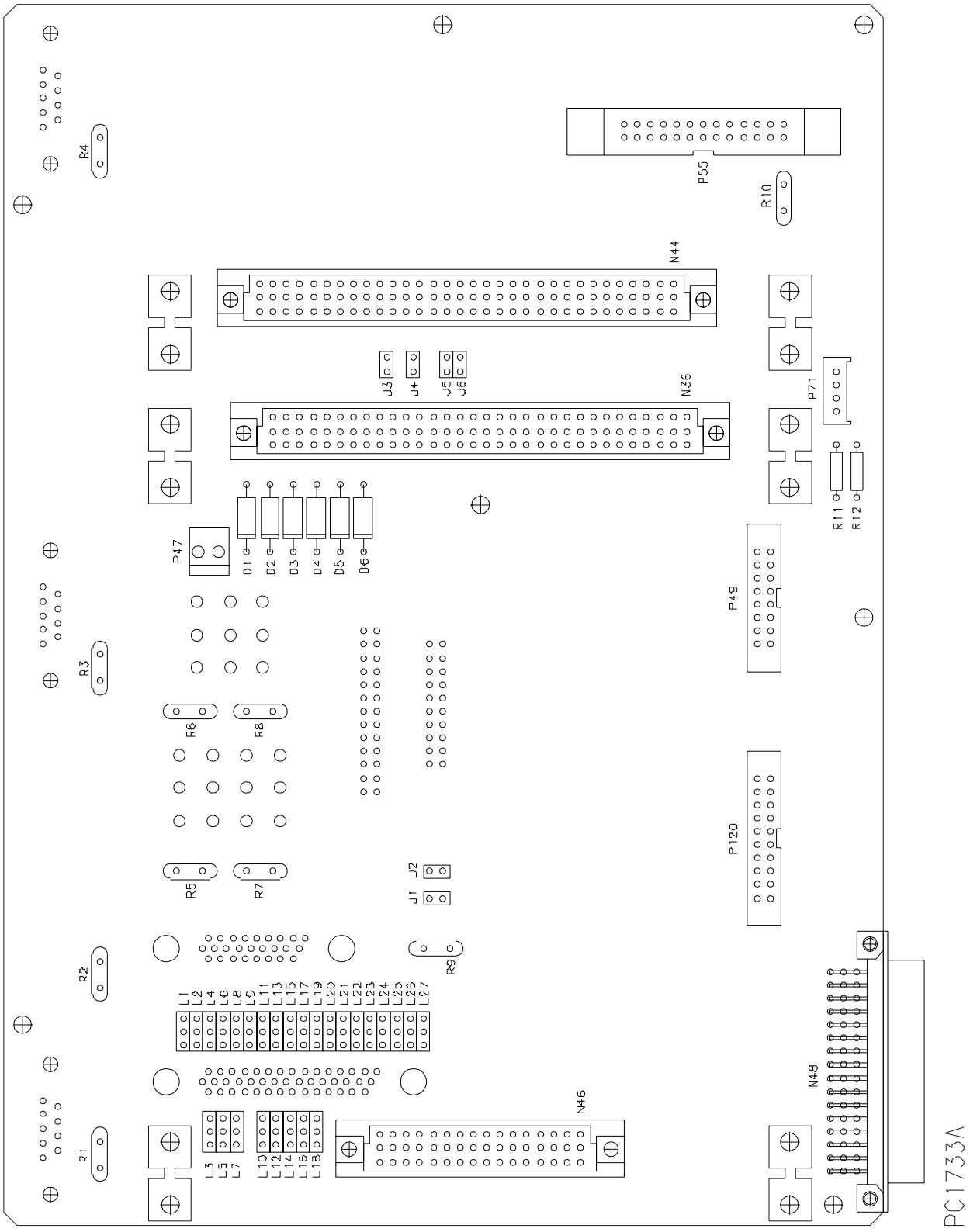


PC 1761 MIB Connector – Layout, page 1 (1)

8

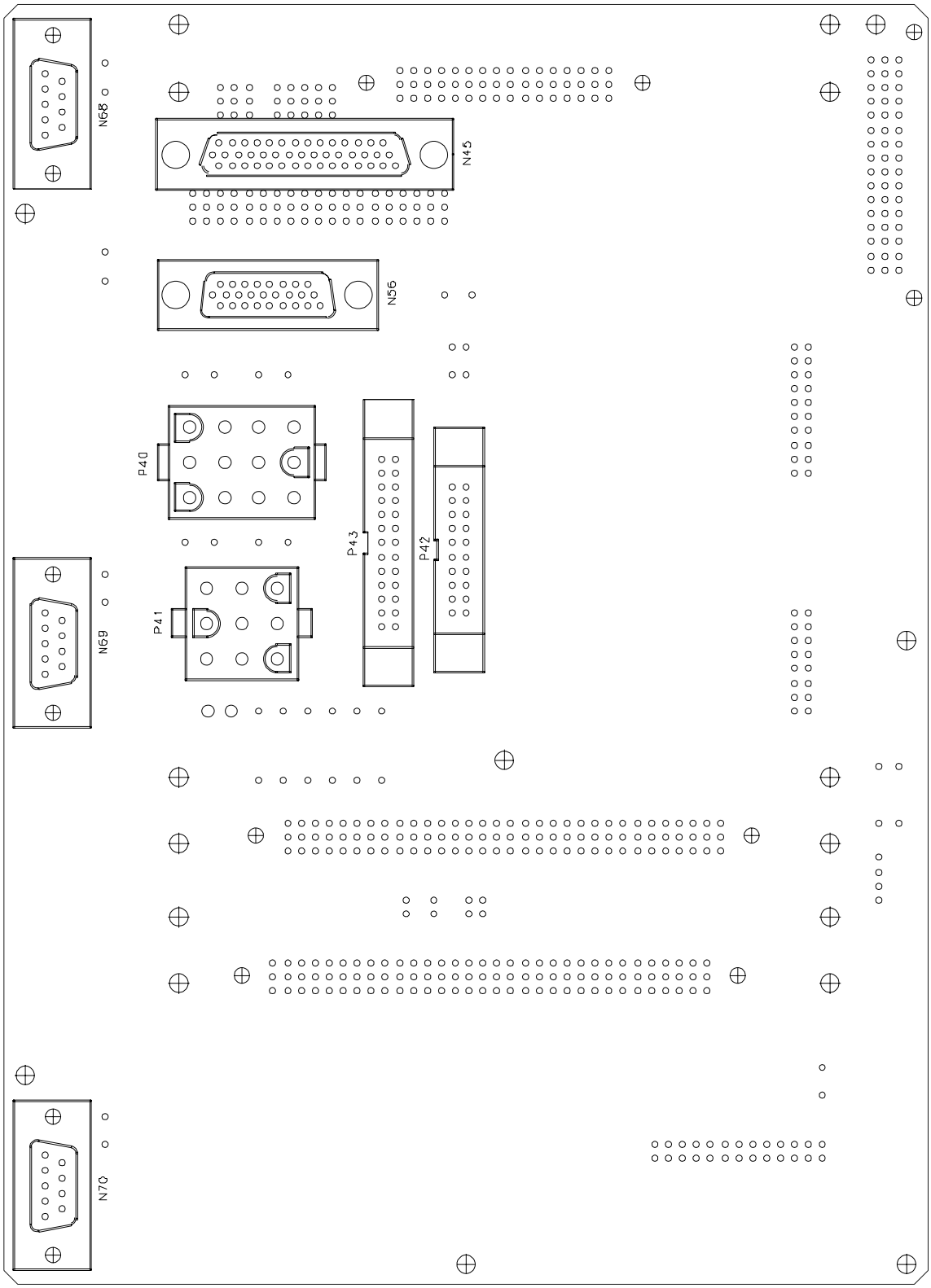


PC 1761 MIB Connector – Circuit diagram, page 1 (1)



PC 1733 Interconnection – Layout, page 1 (2)

8



PC 1733 Interconnection – Layout, page 2 (2)

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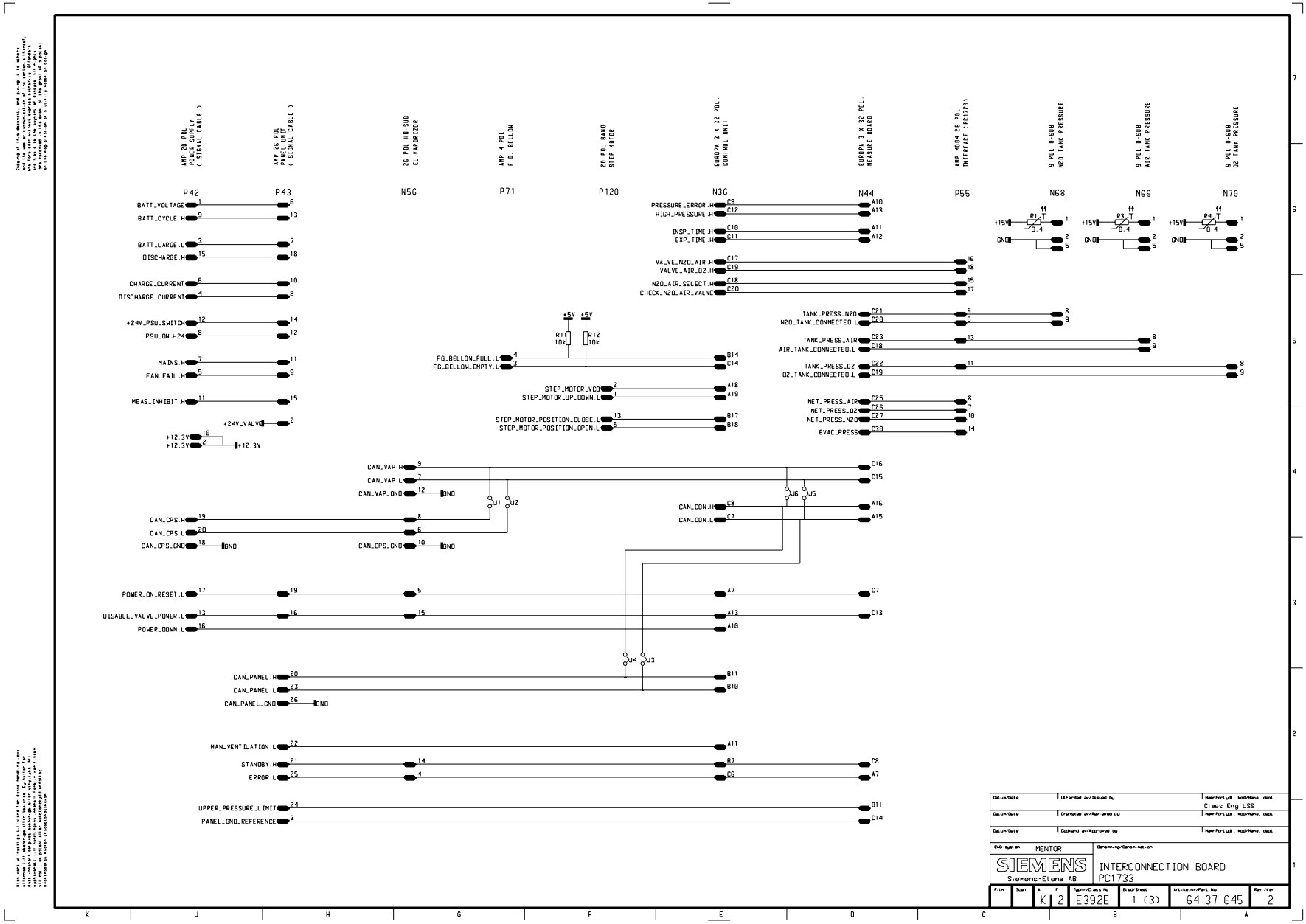
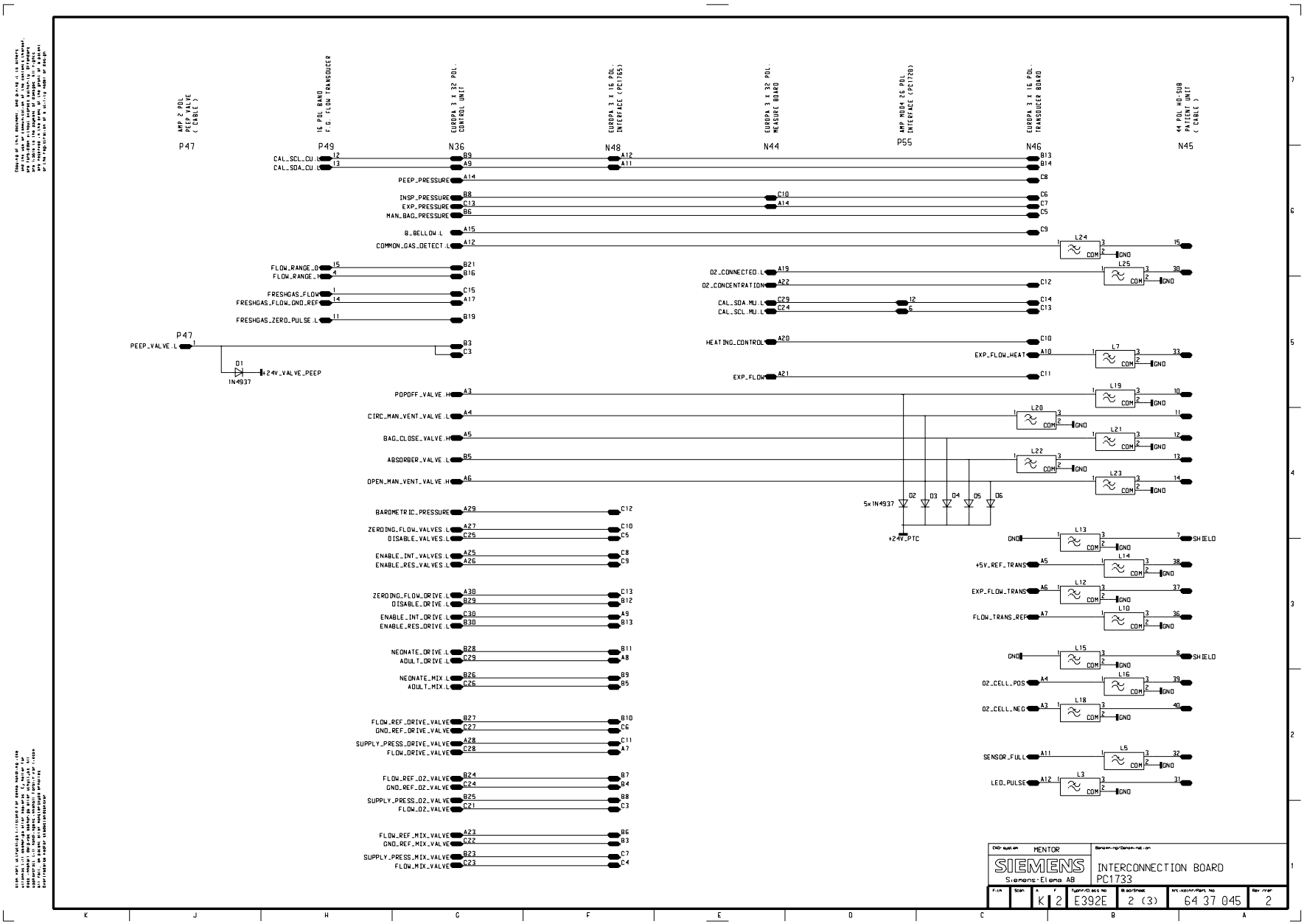
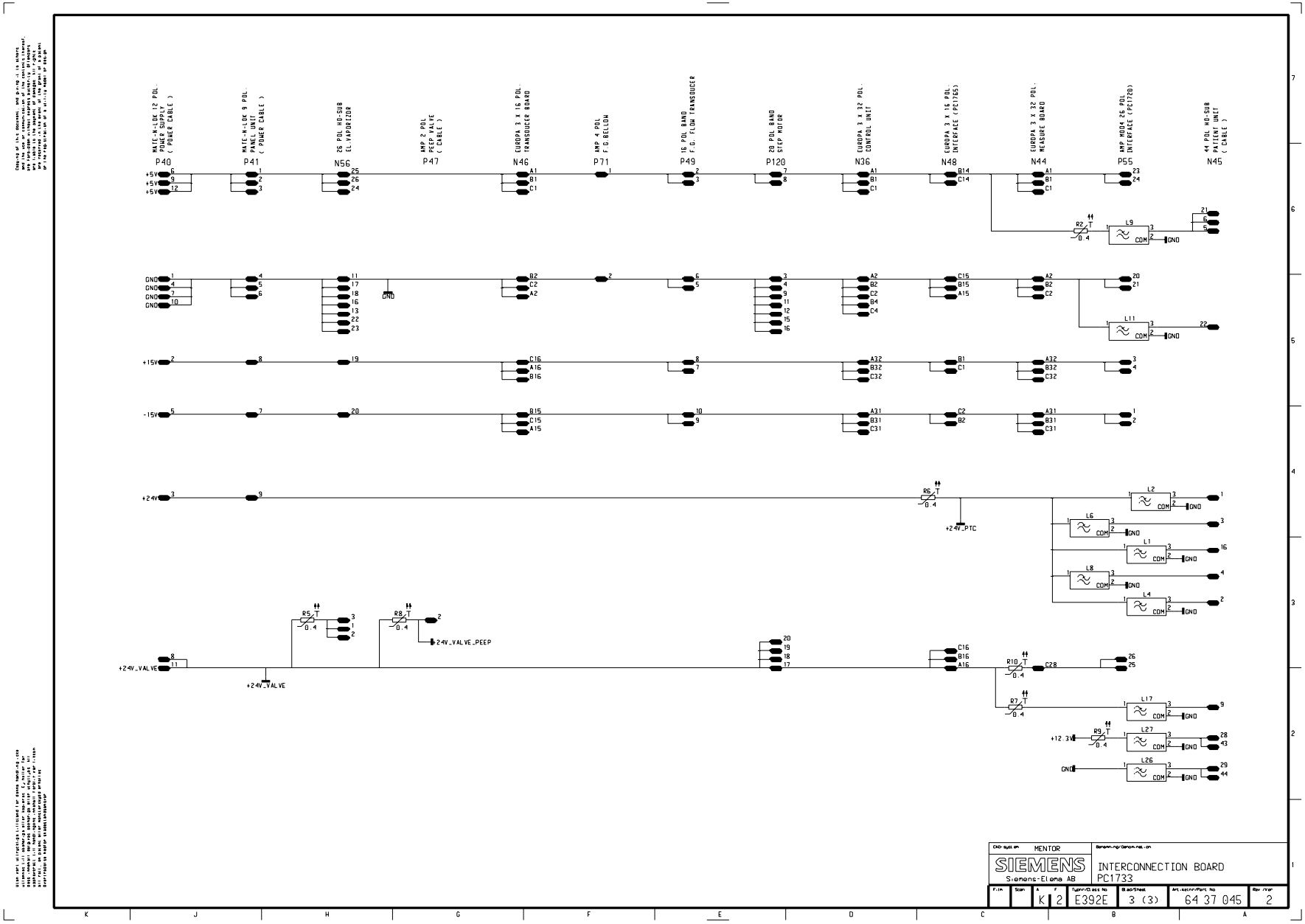


PC 1733 Interconnection – Circuit diagram, page 1 (3)



PC 1733 Interconnection – Circuit diagram, page 2 (3)



PC 1733 Interconnection – Circuit diagram, page 3 (3)

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